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Front Cover
The cross-country skier in this photo by Matt Fischer represents only one of a legion of cross-country enthusiasts who will hit Montana's slopes and backcountry trails this winter.

Inside Front Cover
Immature peregrine falcon, by Jon Cates. The future of this endangered bird in Montana looks brighter because of a peregrine recovery program.

Back Cover
Paul Dix's back cover scenic of cows grazing is an artist's palette of winter's subtle shadings and tones.

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Out of the Closet and Onto the Slopes

by Tom Ellerhoff

IT'S OKAY. You don't have to be shy anymore. The days of hiding the fact that you prefer cross-country skiing to downhill are over. Sure, I remember the early 1970s—well before the creation of groomed ski trails, abundant "how to" guides and trouble-free cross-country ski equipment—when party talk would turn to skiing.

"I just had the greatest weekend skiing the Gloryhole at Sundown Slopes," one person would exclaim. Then another would add, "Boy! Wasn't that Corkscrew Hairpin just about the most challenging slope you've ever skied?"

I still shudder, remembering how the recapping of experiences would pass from person to person, creeping ever closer to me—a closet cross-country skier.

photo: Matt Fischer

Finally, someone would venture, "Well, Tom, what slopes have you been attacking?"

"Lolo Pass was kinda nice last weekend," I would softly reply, hoping for no cross-examination.

Every eye in the room would turn toward me. You could see the wheels churning in the heads of the snow bunnies, turning my Mr. Smooth Slopes image to mush.

Not that I hadn't made a stab at learning the graceful art of downhill skiing. My first trip to a ski area was in the summer of 1971 and, frankly, I couldn't believe *anyone* would traverse such mountain roads in the winter. Of course, I didn't realize that the winter roads—well-plowed, sanded and with snow-banks on either side—probably were safer than the same roads in summer.

My second reaction came when I actually *saw* "the slopes." I recall getting out of the car at the base of one of the more difficult runs and thinking, "I probably couldn't even walk up that!"

My return trip to the ski area that winter was mostly, well . . . okay. First, the roads were great. I was more secure than when I went up in the summer. More acclimated. The people were helpful and friendly, and the ski boots I rented felt good. All things considered, I looked pretty good in the Lodge. Gathering up my courage, I stepped outside, put on my skis and promptly fell down. It was pretty much like that all day as I shuffled back and forth on the "bunny hill" or "dope slope."

While I struggled, kids about up to my kneecap tore around me like blazing snow hares. I chalked that up to youth and the fact that, as a group, they were utterly fearless. I learned early that bravery wasn't my long suit—in fact, it wasn't even my short suit. Fortunately, I was able to place at least partial blame on the fact that I was born and raised an Iowa flatlander.

After a few more outings, I was showing only minimal signs of improvement. I was bemoaning my lack of progress to a friend who happened to be an exceptional downhill skier.

I told him I needed more practice but, because of work, couldn't get to the ski hills often enough. He sympathized, and said he had a possible solution.

"I was helping a friend move a week or so ago," he said, "and when we were cleaning out the garage, we came across a pair of old Army cross-country skis. He asked if I wanted them and I said sure, but since everyone in our family skis downhill, they'll probably just gather dust. You certainly can have them if you want, and maybe you can get the practice you need."

When I arrived at work the next day, the cross-country skis were leaning against my desk. They were longer and thinner than I had imagined. In fact, the length began to worry me a lot. If I couldn't turn well with comparatively short skis, what was I going to do with these things?

A closer inspection revealed they had, in fact, belonged to the Army and, by their finish, it appeared that it had been to the Grand Army of the Republic rather than to World War II mountain troops. They were solid hickory and had a hard, green compound on the bottom.

"Well, what do you think of 'em?" Recognizing my friend's voice, I replied, "They look a little long and not very stout."

"I don't know much about cross-country skiing, but I think they're about your size. Let's check. Hold one of your arms straight up over your head," he said.

I did so, and he held one of the skis alongside of me. The tip of the ski hit the middle of my wrist.

"A perfect fit," he announced.

I was glad the things were my size, but I still didn't know if there was anything I had to do, other than strap them on and start skiing. My questions were answered when my friend added, "You know you have to wax these a lot more than downhill skis, but I'm afraid I don't know much about that. You also have to put a base on the bottom before you can begin waxing. I wish I could help. Maybe the public or university libraries have a book or pamphlet on it."

Being no stranger to libraries, I was confident they wouldn't fail me. I was wrong. I couldn't find a thing about putting on a base or waxing; in fact, it was difficult to find even a general article on cross-

photo: Tom Ellerhoff

country skiing. Feeling a little disappointed that my dependable sources of information had failed me, I decided to do the next best thing. I copied down all the addresses of sporting goods stores from the local yellow pages section and began a systematic search.

My efforts were unrewarded. The stores that had cross-country skis had them jammed in dim corners, indicating these weren't hot items.

When I asked about waxing in one store, a clerk suggested that I try paraffin.

I hit all the stores in town except a small, out-of-the-way place near my apartment. The owner was a man who had run a successful sporting goods store in a larger city. He made enough to retire comfortably, but finding retirement didn't fit his work ethic, he opened this one to "keep his hand in the business."

By chance, the small sporting goods store had a sale that weekend and I dropped in to see if there was anything of interest. As I suspected, the sale items weren't much, so I began to browse around. I glanced over at the ski section and noticed something unusual. Unlike the other stores, the cross-country skis were displayed along with the downhill skis. And there was a selection—he carried two different brands. There were also poles and a limited selection of waxes. I knew what it felt like to strike gold.

My excitement or, more likely, amazement caught the eye of the owner.

"May I help you?" he asked.

I explained the origin of my skis and asked if he had anything that would explain how to apply a base and wax them.

I followed him to a part of the store that had a number of "how to" books. Many of them looked as if they had been written by popular sports figures of the 1930s. Bending down and adjusting his glasses, he ran his index finger across the titles.

"Yes, here we are," he said, pulling out a dust-covered, paperbound book. "This should at least get you started and give you some idea about waxing."

I thanked him, paid for the book and headed for my favorite reading chair. After examining the sections on applying a base and waxing, I thought I must have missed something, so I reread them a few more times. The whole process looked awfully messy. First, I would have to scrape off the green stuff (I never did find out what it was). Then, after making sure the surface was clean, I would have to coat it with pine tar. To form a bonding seal with the wood, the pine tar had to be heated—with a torch, no less. What was left was supposed to be wiped off and—finally—the skis were ready for waxing.

For a fun sport, this was beginning to resemble unfun.

Before reading the instructions, I had never heard of pine tar. After finding out what the stuff was, I tried to find some. Three days later, I was beginning to wonder if it existed outside of some writer's dusty imagination.

I was telling some friends about my troubles when one of them who had horses said, "Shoot, whenever I need some, I go to the vet."

Considering what I had put up with so far, going to a local veterinarian to purchase pine tar for my skis seemed a small price to pay. Besides, I didn't have any choice.

Putting on the base proved to be every bit the mess I had supposed. My hands felt like they belonged to Spiderman when I finished applying the bubbling hot pine tar, and my finesse with the torch had been such that I scorched only small portions of both skis. All in all, I didn't do badly, particularly when one considers that the possibilities ranged from perfection to two slats of charcoal smoldering at my feet.

The next step was waxing. Most people think all the skill centers around one's ability to cross-country ski. However, these folks usually change their minds when they discover they've put on a wax that's too soft for the snow conditions and they're tromping around with great globs of snow solidly bound to the bottoms of their skis.

The price of overwaxing is the gooey task of removing soft, sticky wax, then rewaxing with a harder wax.

Unfortunately, experience is the best teacher. Once you gain a respect for the waxes, you also learn about such things as a "kicker." A kicker is used when you find yourself faced with changing snow conditions. Instead of applying a soft wax along the entire length of the ski, you apply a hard wax, then spread the softer wax in the middle third of the ski. Thus, if the softer wax proves too soft, you only have to scrape a third of the ski.

Having confronted waxing and base application with limited success, it was time for a trial run. Since this was well before the cross-country ski boom, I couldn't enlist a local "expert" to teach me such rudimentary techniques as moving forward, stopping, changing direction and recovering from a spill.

As with downhill skiing, I spent the better part of my first outings falling down. I also discovered my body and legs bent in directions I couldn't even imagine. Getting up from these falls often proved to be the most grueling exercise of the day, especially when the snow was waist deep.

Persistence was the key. The more I persevered, the less I fell. Since the skiing motion was akin to a blend of striding along at a brisk pace and roller skating, I became more and more comfortable with the gliding, rhythmic gait.

As my confidence grew, so did the scope of my travels. I went from skiing in relatively level open meadows and forest roads to high, secluded mountain trails. This led to one of those miserable "learning experiences." My overconfidence tempted me up a steep, remote mountain trail at a time when the snow was encrusted with a layer of ice. Beneath the crust, the snow was powder and, although the going was laborious, I didn't think much about it. The depth of the snow diminished the higher I climbed until, as I neared the crest of the mountain, I discovered I was skiing on nearly solid ice. Apparently, the wind had whipped most of the snow from the ridge, and the remaining snow had turned to ice. *continued on page 37*

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New Study Shows Elk See Colors

by Doug Scott

It had been a late November whitetail hunt, and the story drawled by my biologist-friend from Georgia was familiar.

"I picked a good spot in the middle of a wax myrtle thicket. It gave a fine view of a deer trail below, and a slight breeze was in my face. After I had been sitting quietly for a half-hour, a little doe walked up the trail toward me. She chomped on some honeysuckle about 25 yards away and stopped to look around. All of a sudden, her eyes and ears shifted to my bush, and then she practically turned herself inside out, spun around and tore back down the trail. This hunting vest may keep me from getting shot, but the deer can see it a county away."

The vest Bill hooked his thumbs on was bright fluorescent orange, a color that also goes by the names of hunter, blaze, safety, signal or daylight orange. Regardless of what it is called, many states and provinces require big game hunters to wear outside garments having a certain minimum number of square inches of this color. The idea behind these laws is simple: If a hunter wears bright clothing, this should help prevent him from being shot while hunting. Of course, the only cases where increased visibility will help prevent accidents are when a hunter is mistaken for game, walks into the line of fire or is shot by another hunter swinging his firearm on a moving animal. Fluorescent orange won't help the careless hunter who ventilates a foot while loading his deer rifle.

Fluorescent orange was not chosen as a safety pigment by accident. The U.S. military and the state of Massachusetts performed extensive tests and found that the dominant wavelength (color) emitted by the fluorescent orange pigment could be seen by humans under a variety of conditions and could even be detected by many color-blind persons. It was found to be more visible than any other normal or fluorescent color.

In 1962, Massachusetts became the first state to pass a law requiring hunters to wear fluorescent orange. Since that time, many states have adopted bright clothing requirements, usually for big game hunters only. Now, about half the states and Canadian provinces enforce this type of hunting law. The sporting goods industry has been quick to

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The following articles on fluorescent or "hunter" orange are reprinted from the September 1981 issue of The American Hunter, *an official publication of the National Rifle Association (NRA). The research described by Dr. M. Douglas Scott, Institute of Natural Resources, Montana State University, was conducted with the help of an NRA grant-in-aid.*—Editor.

capitalize on these regulations, and the safety-minded hunter can buy not only orange coats, caps and vests, but also orange saddle bags, backpacks, mittens, and long johns.

In many states, the passage, or attempted passage, of orange clothing laws has met with less than complete sportsman enthusiasm. Some hunters want to blend in with the natural colors around them and dislike looking like a billboard. In other words, their objection is for aesthetic reasons, and aesthetics are a valid and important part of any hunt. The greatest number of objections, however, comes from hunters concerned that game animals can see the bright garments as well as humans can. This concern has led to many spirited discussions around the campfire and numerous magazine articles on whether or not different animals can see colors.

photo: Bill McRae

When hunters and outdoor writers went to biologists for an answer, they didn't get much help. Biologists knew that most big game mammals were active at night, as well as during the day. For many mammals (including humans), structures in the retina of the eye, called rods, are used almost exclusively for nighttime vision. Research has shown that rods do not differentiate between wavelengths of light (color) but only produce information about *quantities* of light. This information is later analyzed by the nervous system. Biologists put these two facts together and *assumed* that the animals, being nocturnal, would have rod-dominated retinas and would be color-blind. This assumption was reinforced by some outdated, oversimplified studies on color vision in domestic animals like the cow, horse, dog and cat. These studies seemed to indicate that domestic animals are totally color-blind. The result was that biologists, using the best information available to them, told the public that most big game mammals were probably color-blind. This was repeated in many books and articles, and somewhere along the way, the word "probably" was dropped.

It's somehow reassuring that science never did, and never will, have all the answers. Observations by hunters like my friend Bill seem to indicate that some wild animals, such as deer, could detect colors. I went to the library and found out that science has made great strides in studying color vision in the last few years—particularly in the areas of anatomy (structure) and physiology (function) of vision organs. One thing became very clear, however. *No* large, wild North American mammal had been studied to determine if it could discriminate colors. In fact, veterinarians in Texas recently found that white-tailed deer have many cones (color vision structures) in their retinas, and they obtained electrical responses from the deer retina that indicated colors were detected. They obtained similar information for the domestic cow, sheep and pig. Closer to my home, I talked to a former doctoral student at the University of Montana, and she informed me that she had found cones in the eyes of the American elk, or wapiti.

Armed with this information, it seemed time to do some controlled behavioral tests to see if members of the deer family actually were able to discriminate a pigment, fluorescent orange, in the field.

Specifically, the tests we designed were set up to answer the question of most importance to a hunter: "Can a big game mammal discriminate the fluorescent orange pigment from other pigments that resemble the animal's natural surroundings?" Readers should note the use of the word pigment here rather than color. Visible white light from the sun contains a mixture of all the wavelengths seen by humans. When white light is passed through a glass prism, it is separated into the different colors—each having a narrow wavelength band. A rainbow produces the same effect. Human eyes and brains interpret shorter wavelengths as blue, while the

longest visible wavelengths are called red. These colors are pure colors because, once separated, they are not mixed with any other wavelength that is greatly different.

In the world around us, we seldom see pure colors, such as those produced from a rainbow. Instead, we see pigments (such as paints, photographs and dyes) or other objects that are made up of many kinds of molecules mixed together. In many cases, the most abundant molecules reflect a dominant wavelength of light that overpowers colors reflected by different kinds of molecules present in smaller amounts. The result is that the object is called one color by humans—like orange, or green—but it may be reflecting other colors we don't notice.

Almost any pigment, including fluorescent orange, reflects a variety of colors in addition to the dominant one we humans detect. Therefore, when we test an animal to see if it can differentiate fluorescent orange from other pigments, it may see something in the pigments of which we are entirely unaware.

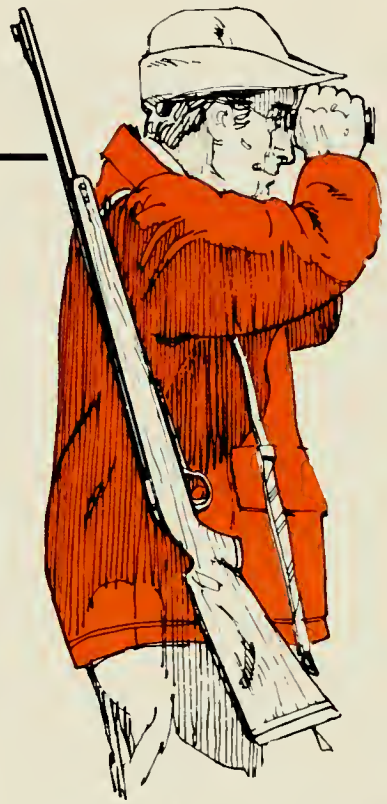
It would be nearly impossible to do vision tests with completely wild big game animals, so we had to find some semitame animals near the Montana State University campus. We were fortunate to locate a herd of captive, tame elk in Corwin Springs, just north of Yellowstone National Park. We used two yearling females and a yearling bull for the tests. (Older animals, while tame, were too unpredictable with which to work.) We trained the elk to eat out of large five-gallon plastic buckets, then trained them to seek a reward of fresh apple slices from a bucket painted fluorescent orange.

The orange bucket was placed in a line with four identical buckets of various colors (green, brown, greys, white, black) inside a corral. All buckets were coated with apple juice and small fragments, so scent could not be used as a cue to the reward. The apple reward was placed in the deep orange bucket so that the elk could not see it until they approached to within three feet. An approach this close to a bucket was counted as a choice even if the elk did not touch the bucket looking for a reward.

After the buckets were set up, an elk was let in the corral and allowed to make a choice. After the choice, the elk was moved out, and the buckets randomly rearranged for another test. (The rearrangement was made so that position of the correct bucket could not be learned.) One National Rifle Association staff member suggested we test cloth (as used in hunting clothing), as well as the paints, so we ran tests with both solid and camouflage pattern fluorescent orange cloth versus solid and camouflage cloth of other colors. We made sleeves out of the cloth that fit over the buckets. To make sure the odor of the fluorescent paint wasn't a cue, we put colored sleeves over different colored painted buckets (like an orange sleeve over a brown-painted bucket). For a last test, we substituted a nonfluorescent orange bucket for the fluorescent orange one to see if the elk still recognized this.

After hundreds of tests, the results of these experiments were definite: All three elk, for all the tests, picked the fluorescent orange painted, or cloth-covered, bucket more than 90% of the time. When nonfluorescent orange was substituted, they still knew what we call orange contained the reward. As a last check, we then put the apple reward in a different colored bucket. Using only this bucket and the orange

Can Orange Make



During a mule deer hunt near Rifle, Colorado, an incident occurred several years ago that proved the value of fluorescent orange hunting garments to me beyond any doubt.

It was about midmorning on a clear October day when I sat down on a rock outcropping on a ridge that overlooked a broad, wooded valley. My high vantage point gave me a clear view of two fluorescent-orange-clad hunters moving through the trees almost directly below me. While I watched them, I spotted another patch of orange, then another and another. Within a minute or two, I had spotted nearly two dozen hunters within rifle range of where I sat. Farther away, small dots of orange glared up through the trees all the way to where the valley sloped up to the opposite ridge line.

I had known there were a lot of hunters in this area, but this was ridiculous. If a buck had shown himself anywhere below me, it would have been impossible to shoot without zinging a bullet dangerously close to at least one hunter. The frightening part was that had it not been for the fluorescent outerwear required by Colorado law, I am convinced I would never have seen most of those hunters. Discouraged, I left the area, vowing to find a place to hunt where other hunters were scarce. But I left as a devout believer in fluorescent orange.

The tests in the accompanying article show conclusively that game animals can see fluorescent orange. This may have a significant effect on your hunting methods, but a good hunter should not find himself seriously handicapped.

On one occasion, with the wind steady in my face and bare rock underfoot, I crept up within 10 yards of a button buck that was calmly foraging for acorns. I did it by moving only when the buck's head was down and standing perfectly motionless when he looked up. Finally, he looked directly at me as I stood in clear view in all my blaze orange glory. He still wasn't alarmed until, tired of the game, I clapped my hands, and he took off with his flag waving. This was

bucket, it took nearly 90 trials before the elk stopped going to the orange bucket. The only conclusion is that elk (a member of the deer family) can easily discriminate fluorescent orange from other pigments.

What does this mean to you and me when we pack our gear in preparation for opening weekend next deer season? First, the results do not say you should leave that orange vest behind—it still has safety value. [Plus, in Montana, it's the law. A big game hunter, excluding those using bows and arrows, must wear 400 square inches of hunter orange material as exterior garments above the waist.] We are currently finishing analysis of data from a nationwide hunter-orange safety study. The wise hunter should realize, however, that he can't just lean against a tree at his favorite deer stand and expect a wary old buck simply to see that orange coat as a nondescript shade of grey that blends in with surrounding colors. In spite of this, even if the nonconcealed hunter's clothing can be detected by an animal, the hunter still has two things going for him: The animal (especially young ones) may not have learned to associate the orange with danger, and the animal simply may not notice the motionless hunter immediately. Several times, I have been standing or sitting in the woods while wearing orange and had other hunters walk in plain sight of me less than 50 yards away. They never noticed I was there until I whistled.

One of the most common sights during the opening week of elk season is that of an orange-clad hunter strolling on the crest of a ridge above, or slowly meandering through, a big meadow, carefully following every step of an elk that walked through the new snow the night before. Those walking neon hunters are certainly safe from being shot, and they are equally safe from seeing that big bull watching from the spruce thicket on the other side of the meadow.

As in nearly all hunting situations, regardless of your clothing, a successful hunter is one who is seldom seen.■

You a Better Hunter?

possible because I was able to defeat the buck's smell and hearing, two senses that deer rely on far more than sight. A deer may be able to see fluorescent orange, but he may not associate it with danger unless his nose and ears confirm it.

Paradoxically, the use of fluorescent orange may actually make you a better hunter by forcing you to be more aware of the need for those skills that set a good hunter apart from the rest. Among these skills is the ability to use the wind to the best advantage.

Most hunters are aware that it is a good idea to stay downwind of game. Better hunters are able to predict wind direction and shifts by knowing the environmental factors that affect wind currents.

Also important is using available concealment to make yourself as inconspicuous as possible. The good hunter never allows himself to be silhouetted against a skyline and moves on the shadow side of trees and terrain features. He also will use a screen of brush to break up his outline when he pauses, rather than stand in the open.

Also, many hunting techniques do not rely heavily on the quarry being totally unaware of the hunter's presence. Some actually are designed to let the deer know he is there. The old-fashioned deer drive is one of these.

One variation on the deer drive that is especially productive is well-suited to a party of two or three hunters. It also is effective in sections of woods that are too large for a conventional deer drive.

In this method, there are no blockers. All hunters are drivers, and the drive is planned to move *upwind* through the cover. The drivers station themselves abreast, close enough that visual contact is easily maintained. Fluorescent orange actually is a plus in this situation, both for safety reasons and because it is essential that each driver be able to see adjacent drivers for this method to be effective.

As the drive begins, it resembles stillhunting more than a conventional deer drive. Using a hand signal to start, every second hunter moves forward with as little noise as possible, keeping a sharp watch to his front. Meanwhile, the remaining hunters stand quietly, using available cover to break up their outlines. Their attention also is directed to the front, paying special attention to low spots, edges of thickets and blowdowns that a buck might use as an avenue of escape.

The lead drivers move forward only as far as they are able to see the trailing hunters, usually 50 yards or less. Then, again using a hand signal, they take a stand and the trailing hunters move forward.

Alternately standing and driving in this fashion, you use a wary buck's instincts against him in several ways.

First, the lead stalker, if he is good enough and lucky, may surprise a bedded buck. More likely, the buck's sharp ears will pick up the furtive sounds of the driver sneaking through the woods. Most big bucks prefer not to bolt away from danger and will lie low or sneak away by circling silently downwind.

As the lead stalker stops to allow the trailing hunter to move forward, a hiding buck may think he has been spotted and bolt, offering a quick shot to the lead hunter. If the buck tries to sneak past him, the trailing hunter lies in wait.

The main point is that in this method and most others, a fluorescent orange garment is little or no handicap. Even those who prefer to hunt from a stand should find little difference. In this case, proper camouflage and awareness of wind direction play a far larger role in putting venison on the table.

Confirming this view is the fact that despite laws in 30 states and four Canadian provinces requiring hunters to wear some kind of fluorescent orange outerwear, harvest figures and hunter success ratios have shown no decline that can be attributed to fluorescent orange. More important, it *is* the law in those states, and whatever your viewpoint, the prudent hunter will comply, both for safety's sake and because breaking any game law is unsportsmanlike and against all our best interests.—*Stan Skinner, managing editor, The American Hunter* ■

the successful staging of a classic comeback

Some 30 to 40 million pronghorn antelope, a population that rivaled the buffalo as the most numerous of the prairie large animal species, once roamed the vast grassland regions of the American West.

As with other prairie species, pronghorn populations drastically declined in the face of advancing settlement. By the early 1920's, this species, which could once be counted in the millions, had been reduced to less than 13,000 animals.

Fortunately, the efforts of western state wildlife agencies began before it was too late. Through live trapping and transplant operations such as this helicopter roundup, thousands of pronghorn were relocated to new areas of habitat. Most of the money for these programs has come from sportsmen, through hunting license fees and special taxes on equipment.

Once threatened to the point of extinction, there are now over 400,000 pronghorn in the western states.

For a free copy of "Un-endangered Species, The Success of Wildlife Management in North America," write to NSSF, Dept. A, 1075 Post Road, Riverside, CT 06878.

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The Catchall

Elkhorn Mountains Dedicated to Wildlife

The Elkhorns—a mountain range lying 20 miles east of the Continental Divide and only 15 minutes from Helena (see map)—have been a center of controversy regarding land use and its effects on wildlife for 25 years. During these years, the public has strongly urged positive U.S. Forest Service recognition of the wildlife values of this area. Within the Forest Service's planning process, the Elkhorns have gone through a series of plans, each having a somewhat different direction. The most recent decision—a U.S. Department of Agriculture ruling on the Elkhorns Wilderness Study Report in November 1981—decided against wilderness management for an 88,000-acre, high-elevation portion of the mountain range in favor of a Wildlife Management Area where a more ecologically complete zone would be managed with wildlife as the principal resource value. Part of the rationale behind this decision was that there had been divided public opinion on the issue of wilderness, but a universal expression of interest and concern for wildlife in the Elkhorns.

The Elkhorn range, which lies between Helena, Townsend and Boulder, encompasses approximately 200,000 acres, three-fourths of which is under jurisdiction of the Helena and Deerlodge National forests. The area receives intensive recreational pressure because of its proximity to urban areas, its good wildlife populations and its semiprimitive nature. The wildlife values of the Elkhorns are significant and, in some respects, unique. For example, the majority of elk winter range in Montana occurs on private land, whereas in the Elkhorns 80% of elk winter range occurs on public lands, thereby offering opportunities to provide for the year-round needs of the elk. The hunting district encompassing the Elkhorns is among the most intensively hunted areas in the state. In addition to elk, hunting opportunities for deer, moose, mountain goat, bear and mountain grouse are available.

In implementing the U.S. Department of Agriculture's direction for a Wildlife Management Area in the Elkhorns, the Helena National Forest enlisted the involvement of the Montana Department of Fish, Wildlife and Parks. Together, these agencies have been developing specific management guidelines for activities such as timber harvest, recreation, livestock grazing and energy development to ensure that these activities, when they occur, are compatible with wildlife values. The Department of Agriculture stipulated in its November report that (1) there would not be a transmountain road constructed across the Elkhorns as was once planned, (2) vehicle access would be reduced and limited to protect wildlife values and (3) wildlife habitat would be managed to maintain viable populations of existing wildlife with emphasis on certain species requiring seclusion.

The Forest Plans detailing specific management direction in the Elkhorns will be issued late in 1982. An important component of that management direction will be an on-going monitoring and evaluation program wherein current activities will be assessed and altered if necessary to promote wildlife values. The decision by the Forest Service to manage an area as large as the Elkhorns for wildlife is indeed a positive approach to recognition of wildlife values on national forest lands. The commitment to wildlife and progressive wildlife management which will evolve from this program promises to be significant.

A comprehensive article dealing with each resource issue as it may affect wildlife in the Elkhorns and the possibilities of extrapolating the Wildlife Management Area approach to other areas will be forthcoming in a future issue of *Montana Outdoors.*—*Rich DeSimone (A biologist for the Department of Fish, Wildlife and Parks, DeSimone is assisting the U.S. Forest Service in development of a Wildlife Management Unit in the Elkhorn Mountains.)*

Wildlife Film Festival Entries Sought

The University of Montana chapter of The Wildlife Society will sponsor its fifth annual International Wildlife Film Festival this spring and is seeking entrants for the competition.

To be eligible for the 1982 competition, films must have been produced or released in 1981 and be primarily about wildlife. Films on habitat or research are acceptable if they focus on the wildlife species involved. Films in both professional and amateur categories are judged on artistic quality, art form, biological accuracy and message. Entry deadline is March 19.

The 1982 festival will be April 16-18 at UM in Missoula. Winning films will be shown and panels and workshops on filmmaking, wildlife and related topics will be presented.

For additional information, contact: Wildlife Film Festival, Wildlife Biology Program, University of Montana; Missoula, MT 59812, or telephone 406/243-5272.

Subscription Problem?

When you order or renew a subscription to *Montana Outdoors*, the magazine won't be in your mailbox the next morning. Sometimes the process goes onward without a hitch; other times, it seems to have more knots than a beginner's fly line.

When our office receives your subscription, the payment must be validated so our income can be recorded; this information is registered on computers at Charter Data Services, Inc., in Des Moines, Iowa, and your payment is posted to our account. The address information is also entered in the computer and from this data, your address label is prepared.

All of this takes some time (around Christmas, it takes longer), and it may be six to eight weeks before you receive your first issue of *Montana Outdoors*. In the meantime, your cancelled check may have been returned to you.

For the convenience of our readers, we have established a toll-free number to assist with subscription-related problems: 1-800-247-5470.

Book Review

THE BOUNTY OF THE EARTH COOKBOOK, by Sylvia G. Bashline, Winchester Press, 1421 S. Sheridan, Tulsa, OK 74114; 1979, 266 pages, $10.95, hardbound.

Increasingly, a topic of conversation at breakfast in our house is: "What shall we have for dinner?" I always hope that someone will be awake enough to offer some decent suggestions. Sure, chicken basted in cream sauce or elk rouladen sounds great. But after eight hours at the office, the thought of coming home and spending one or two hours in the kitchen preparing a tasty dinner doesn't sound too appealing. That's why I'm learning to appreciate Sylvia G. Bashline's "The Bounty of the Earth Cookbook." As she notes: "This book is not for gourmets who have nothing to do but prepare long, complicated recipes with fancy names that no one knows how to pronounce. It is for the millions of people who hunt and fish and need good, simple recipes to bring out the best from the fish and game."

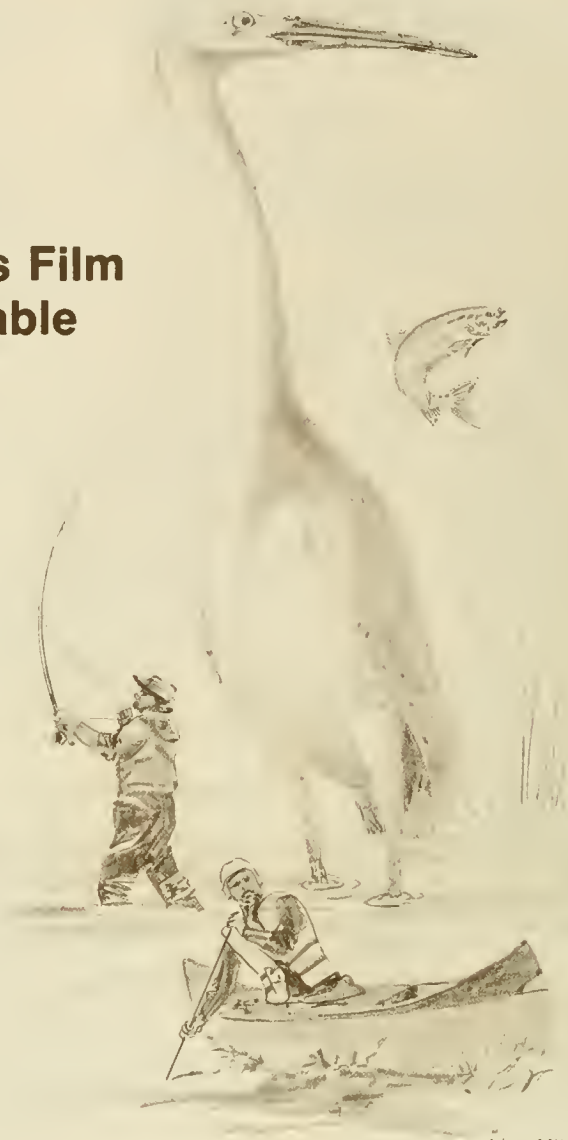
For me, it's easy to throw a few brook trout in a pan, fry 'em in butter and serve them up. But add some seasonings, almonds and vermouth, according to Bashline's recipe for "Trout Almandine," and you've transformed ordinary fried trout into a culinary treat.

In addition to the recipes for fish and game, there are chapters on smoking, clay pot cooking, Dutch oven cookery and recipes utilizing wild greens, mushrooms, nuts, berries and fruits.

One drawback: This cookbook features several recipes for species of wild game and fish not found in Montana, such as quail, woodcock, striped bass, flounder and shad.

Bashline's valuable hints on fish and game cooking, the result of her testing every recipe, are scattered throughout the cookbook. For example, she prefers to fillet northern pike, but if you wish to bake it whole, scale it first. Hints on freezing, field care, wine recommendations and average serving sizes will help improve your efforts in preparing and serving delicious fish and game fare.— *Donita Sexton*

Rivers Film Available



graphics: Mitchell Paulson

"All for the Rivers," a film which presents the free-flowing waterways of Montana with all their energy, splendor and productivity, has been released by the Department of Fish, Wildlife and Parks.

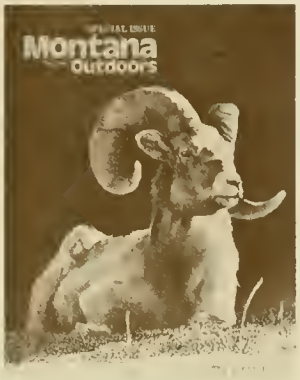
In 26 minutes, the viewer flows through a historic look at our nation's major rivers and how they were perceived, utilized and exploited as the workhorses of early America. The movie then turns to the rivers of Montana, the headwaters of the great rivers which are highly productive in terms of fish, wildlife and recreation. The film also provides the audience with an insight into the biological work necessary to meet the challenge of keeping Montana's waterways productive.

But the fisheries and water quality effort is only half the challenge; the other half is creating active public support to keep our rivers the pride of Montana.

The film was narrated by David Wayne, star of the television series, "House Calls." Major music selections were composed and recorded by "Montana," (formerly Mission Mountain Wood Band). The movie was produced by the department's cinematographer, Mike Gurnett. It is available free as a public service for scheduled showings. To reserve "All for the Rivers," contact the department's Film Center at 930 Custer Ave. W. in Helena (406/449-2426); prints are also available at regional department offices.

Three "Montana" Periodicals

• From time to time, we receive subscription inquiries or other correspondence intended for one of the other "Montana" periodicals. Because there are at least three magazines with the word "Montana" in the titles, some confusion exists over what they are, by whom they are published and what they contain. The following is a brief synopsis of each magazine's objectives and content, along with a picture of a recent cover.—Ed.



Montana Outdoors is the official publication of the Montana Department of Fish, Wildlife and Parks. Begun in its present format in 1970, it provides up-to-date information about wildlife conservation, explains department policies and programs and explores problems affecting fish, wildlife and parks resources in Montana.

Published bimonthly, **Montana Outdoors** includes eight to 10 features in each of its 32- to 48-page issues, as well as a "Catchall" section containing shorter articles and news items. Coverage includes articles on wildlife management, hunting and fishing, natural history, outdoor recreation, general interest topics and a letters-to-the-editor section.

The magazine's trademark is its full-color photography and wildlife art by Montana's finest photographers and artists.

Montana Outdoors has received numerous awards for both journalistic and photographic excellence and has been ranked among the top five state conservation magazines in the United States and Canada in competitions sponsored by the Association for Conservation Information.

Subscriptions cost $5 for one year (six issues), $9.50 for two years (12 issues) and $13 for three years (18 issues). For more information, write **Montana Outdoors,** Department of Fish, Wildlife and Parks; Helena, MT 59620, or telephone 406/449-2474.

Montana Magazine, a privately owned publication founded in 1970, has grown to be one of the largest state-oriented magazines in the nation.

This diverse bimonthly publication gives coverage to all areas of Montana, and includes 10 to 15 major features in each of its 80- to 96-page issues.

The editorial makeup includes sections on history, wildlife, community profiles, travel, personality sketches—all those stories that give life in Montana its unique flavor. In addition, the magazine carries regular departments on geology, weather, wildlife, hunting and fishing, photography and more.

Montana Magazine is probably best known for its center section of full-page color photography featuring Montana scenery and wildlife.

The magazine's writers have won national awards, and the publication itself has been selected as one of the most beautiful regional magazines in the nation by the Regional Publishers Association.

Subscriptions cost $12 for one year (six issues) and $22 for two years (12 issues). For additional information, write **Montana Magazine,** Box 5630; Helena, MT 59601, or telephone 406/443-2842.

Montana the Magazine of Western History, now in its 31st year of publication, is an illustrated journal devoted to publishing local and regional history that instructs readers about Montana's past.

Articles in the magazine, if not diaries and other historical documents, are from original research and each is thoroughly documented. However, the magazine's audience is not limited to professionals; general readers have found the articles to be an outstanding source for Montana history.

Quarterly issues average 76 to 84 pages and normally include four major articles, shorter documentary essays, a full book review section and letters to the editor. Each article is illustrated with period photographs, maps, engravings and other art.

Considered as one of the top state historical journals in the nation, **Montana the Magazine of Western History** also has one of the highest circulations for state journals of its type in the country.

Subscriptions cost $15 per year (four issues) and $25 for two years (eight issues). A subscription also includes the Montana Post, the official quarterly newsletter of the Montana Historical Society and membership in the Society, Montana's oldest public institution. For additional information, write **Montana the Magazine of Western History,** Montana Historical Society, 225 N. Roberts St.; Helena, MT 59620, or telephone 406/449-2694.

Contributors

Tom Ellerhoff began cross-country skiing in the early 1970s—before the creation of groomed ski trails, abundant how to guides and trouble-free cross-country ski equipment. He learned his cross-country skiing lessons in the "school of frequent falls," but his perseverance and enjoyment of the sport led him to graduate with honors. He admonishes: "You don't have to be shy anymore. The days of hiding the fact that you prefer cross-country skiing to downhill are over." Turn to page 2 to discover how he came "Out of the Closet and Onto the Slopes." Ellerhoff, an Iowan turned Montanan and proud of it, works for the Environmental Sciences Division of the Montana Department of Health and Environmental Sciences.

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When **Ken Walcheck** asked Bob Elgas, "When did you first become interested in birds?" Elgas answered, without a second's hesitation, "Well, I think I was born with the interest. It's said that some people are born with a silver spoon in their mouths. I think I was born with a feather in mine." So begins a fascinating biographical sketch of naturalist, aviculturist and artist Bob Elgas. Known in scientific circles primarily for his work with the tule goose, Elgas' interest has grown to encompass a 60-acre ranch near Big Timber harboring rare and exotic bird species, and to a career as an artist whose work focuses on waterfowl. Turn to page 15 for the article, and some samples of Elgas' art expertise. Walcheck continues his duties as the department's information officer for the Miles City region.

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A colorful, speedy falcon, the American kestrel is also the state's smallest. It is the falcon most often seen in Montana, partially because it is one of the most abundant. It is the easiest of all falcons to identify. And, males and females display the greatest color differences found in any American bird of prey. Truly, the American kestrel is "A Falcon of Superlatives." **Vince Yannone** adds to the *Montana Outdoors* nongame series with his article, beginning on page 18. Yannone is the department's youth education specialist.

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There are many sciences for determining what has occurred in the past: geology, archaeology, paleontology, to name a few. Studying the pollen grains in the sediments of a marsh surely is one of the more intriguing routes to take on "A Trail Back Through Time." From these pollen grains, the palynologist can determine which plants grew in or near a pond, changes in the kinds of plants growing, and information about volcanic disturbances, climatic changes, shoreline conditions, and much more. Turn to **Lynn Brant's** article on page 20. Brant is an adjunct associate professor at Carroll College in Helena and also physical science coordinator for the Department of Natural Resources.

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Dennis Flath writes: "The decline and fall of the peregrine falcon is one of the better documented cases of a modern society's failing to accept responsibility for the welfare of public wildlife resources. The peregrine falcon was well along the road to endangered status before most people had any idea it was in trouble." But today, the peregrine's future looks bright, partially because of the efforts of a dedicated group of concerned organizations and individuals, including The Peregrine Fund, Inc.; Exxon; Ralph and Melissa Rogers, and others. Work toward recovery of one of America's most endangered species is now going on in Montana and those participating in the project believe they have taken "A Giant Step Toward Success." Turn to Flath's article on page 30. Flath works from the department's Research Bureau in Bozeman as the nongame species biologist, a position he has held since 1974.

Wildlife Shorts

The bodies of insects are covered by a cuticle. The best known component of the cuticle, chitin, is insoluble in water, alcohol, alkali, dilute acids and the digestive juices of many animals.

* * * * *

In most spider species, individual spiders live only about one year.

* * * * *

A baby whale is the biggest animal baby in the world. A young sulphur-bottom may weigh about 15,000 pounds.
—Vince Yannone, youth educator, Conservation Education Division

If you had to sum up the 76-year history of the department's fish hatcheries program, a single phrase could pretty well do it: "From Cream Cans to Tankers." In the early part of the century, distribution and planting of hatchery fish was done largely by the "cream can" method: Metal cream cans were filled with fish, loaded onto railroad boxcars and shipped to pre-arranged points where department employees or other interested individuals would transport them to nearby lakes or streams. Today distribution is handled by use of sophisticated trucks equipped with temperature-controlled tanks and aeration systems. For a look at the department's hatcheries program, and an explanation of its importance to the sportsman, turn to **Jim Schreiber's** article on page 34. Schreiber is a fisheries field worker at Big Springs Trout Hatchery in Lewistown. He wishes to express his thanks to Bill Alvord (former chief of the department's Fisheries Bureau, and now retired) for a report written in 1975, "History of Fisheries Management in Montana, 1900-1975," from which he drew much information.

* * * * *

MO extends special thanks to:

- The National Rifle Association and its publication, *The American Hunter,* for allowing us to reprint "New Study Shows Elk See Colors" by Doug Scott, and "Can Orange Make You a Better Hunter?" by Stan Skinner.
- **Matt Fischer,** Butte, for his front cover photo of a cross-country skier, and for the two-page spread in "Out of the Closet and Onto the Slopes."
- **Paul Dix,** Emigrant, for his subtle depiction of winter and cows grazing, on the back cover.
- **Jon Cates,** Missoula, for his inside front cover shot of an immature peregrine falcon.
- **Bill McRae,** Fairfield, for his photograph of two hunters in "New Study Shows Elk See Colors."
- **Steve Aller,** McLeod, for his painting of the adult male and immature female American kestrel, illustrating "A Falcon of Superlatives."
- **Robert Neaves,** Corvallis, for his pen and ink of an elk, accompanying "New Study Shows Elk See Colors."
- **Mitchell Paulson,** Helena, for his graphics with "A Trail Back Through Time" and his poster design for the Department of Fish, Wildlife and Parks film, "All for the Rivers."

Bob Elgas (DFWP photo: Ken Walcheck)

Born with a Feather in his Mouth

ON A COLD, blustery day 20 years ago, I stood in the Visitor Center at Alaska's Mount McKinley National Park watching a long line of caribou thread their way across a braided, milk-colored glacial stream. I was so engrossed that I failed to note an elderly gentleman in a Mackinaw approach.

"Marvelous creatures, aren't they?" he said quietly. I soon learned my fellow observer was renowned naturalist Olaus Murie. In the ensuing discussion, Murie's charismatic personality and wildlife expertise captivated me. He was the sort who rarely crosses one's path.

This past year, another special person crossed my path and, like Murie, left deep-rooted impressions. If given the opportunity, no doubt the late Olaus Murie also would have thought highly of him.

I met Bob Elgas by accident. Returning to Miles City from Helena with Harold Miller and Norris Cole, retired ranchers and charter members of the Rosebud-Treasure Wildlife Association, Miller suggested we stop at Big Timber and visit with their old friend, rancher Bob Elgas.

by Ken Walcheck
paintings by Bob Elgas

As we drove down a twisting gravel road which led to the Elgas place, we saw a sign which alerted visitors to nesting birds. A few yards beyond it, some Canada geese and a couple of greylag geese waddled across the road. As we rounded the bend, I saw several rare species of geese and swans, such as the Hawaiian goose and whooper swan—species seen infrequently in waterfowl texts and magazines such as *National Geographic*, but never seen in flesh and feather.

Over coffee at the Elgas' dining table, I soon learned Elgas actually wore three hats—naturalist, aviculturist and artist—each complementing the others.

AS A NATURALIST, Bob Elgas is an authority on certain species of wild geese, especially the tule goose, a subspecies of white-fronted goose. His waterfowl travels have taken him and his wife Elizabeth to 49 states, many Canadian provinces and numerous foreign countries. He has made several expeditions to the Arctic, sponsored by the World Wildlife Fund, the International Council for Bird Preservation, the Smithsonian Institution and the Department of the Interior. He is also a charter member of the International Waterfowl Association and serves as the group's vice president.

As an aviculturist—one who propagates and raises birds—Elgas maintains one of the most complete collections of wild geese in America. His 60-acre ranch harbors rare and exotic species such as Hawaiian geese, bean geese from Sweden, swan geese from China, bar-headed geese from India, pink-footed geese from Iceland and all species of North American wild geese, including the tule subspecies. In addition, he has greater and lesser sandhill cranes; a magnificent sarus crane; trumpeter, whistling and whooper swans, and numerous species of ducks, including the rare "Laysan teal."

I became better acquainted with Elgas and his birds as we toured the ranch. When he threw out a handful of oats and barley, it was tantamount to ringing the dinner bell. There was a gusty beating of wings and a chorus of honks, quacks and mutters as the birds homed in on the feed.

I asked Elgas when he first became interested in aviculture. With no hesitation, he answered, "Well, I think I was born with the interest. It's said that some people are born with a silver spoon in their mouths. I think I was born with a feather in mine." That "feather" became quite apparent when Elgas began describing his 30 or more varieties of birds. He emphasized the key role aviculturists play in a world of increasing human population and shrinking habitat for wild creatures. He cites two classic examples of waterfowl brought back from near extinction by aviculturists: the "Laysan teal" and the Hawaiian goose or nene.

The "Laysan teal," a small and inbred race of mallard, was originally restricted to a tiny mid-Pacific island known as Laysan. Elgas said the species almost became extinct when rabbits, introduced in 1903, destroyed most of the island's vegetation. The population was possibly less than 30 birds in the early 1900s. For several decades, it held on by this thin thread. In the 1950s, aviculturists rescued the small mallard and it made a strong comeback.

Elgas said the Hawaiian nene—or "nay-nay" as Hawaiians pronounce it—is another species rescued by aviculturists at the last possible moment. Western settlement of the Sandwich Islands (as Capt. James Cook named Hawaii) nearly spelled the end of the nene. Goose meat provided a welcome change from salt pork and fish, and thousands reportedly were slaughtered, salted down and shipped to California in clipper ships to feed the forty-niners. By 1911, few remained. The population's low point—less than 50 birds—was reached in about 1950. A last-ditch effort by concerned aviculturists represents what is perhaps the most successful example of using the science to save a species. The nene reared by aviculturists Dr. S. Dillon Ripley and Peter Scott, plus those raised by Hawaiian fish and game officials, brought Hawaii's state bird back from the threat of extinction.

As Elgas continued dipping his hand into a large plastic feed bucket, I felt a nip at my pants leg. Looking down, I saw a lesser sandhill crane eyeing me. "That's Nipontuck," said Elgas, as a deep grin washed over his tanned face. "That's his partner Tucktoyuk over to your right. I've given them Eskimo names, but I call them Nip and Tuck for short." As I bent down for a closer look, Nip—or was it Tuck—came over and began investigating a ring on my finger.

The bird that took center stage, at least in my opinion, was a tall, stately sarus crane called Cranich. The crane greeted Elgas with deep bows and high leaps, interspersed with hops and a quick two-step. It was deadpan comedy, solemn and ungainly, yet oddly beautiful. As we watched the comedian perform, Elgas related a sad story about a female sarus he had had for about three years. While the Elgases were attending an art show, the crane became tangled under a workbench and couldn't free herself. Since cranes can't handle stress very well, she quickly perished. "I was very upset and disappointed," said Elgas. "She was just coming into breeding age. Plus, she was a great pet and you could put your arm around her and walk side by side."

I asked Elgas if he had experienced problems with predators. He noted that raccoons and great horned owls occasionally posed some minor problems, but stray dogs were his biggest headache. "In all the years I have been here, and that's about 40, I have never shot a dog. More than once, I have had a rifle in hand ready to shoot. Then I think maybe this animal belongs to some kid or is someone's pet, so I make an effort to catch the dog, find out where he belongs and take him home."

Elgas then related an unfortunate incident involving a great horned owl and some brant: "In 1962, I went to South Hampton Island in the northern waters of Hudson Bay to collect Atlantic brant. These were the first Atlantic brant taken into captivity and I had something like 20 of them. I came home one evening in late fall. There was about a foot of snow on the ground, and the brant were over in a far pond. I told Elizabeth that first thing in the morning, I would have to get those brant closer

to home before they got into trouble. The next morning I went out and all of them were dead. They were strung out all the way to the house and they had been killed by a great horned owl. His wing and body impressions told the whole story. The details of that incident have never left me, and I have never had a brant since."

A question visitors invariably ask is "How do you keep your birds from flying away?" Elgas uses a method called tendonotomy to make the birds flightless. The surgical technique removes a small segment of the extensor tendon (located in the last joint of the wing). The wing heals in a folded position which prevents the bird from extending it to a normal flight position.

WHEN I asked Elgas about his most significant contribution as a naturalist, he quickly answered, "Well that would have to be my work with the tule [pronounced tu-lee] goose." The story he related was a fascinating piece of detective work spanning nearly two decades. In 1960, Elgas acquired a tule goose from an aviculturist in Oregon and he became involved in trying to unravel a couple of mysteries surrounding it.

Waterfowlers are well-acquainted with the white-fronted goose, *Anser albifrons*. When the bird breaks rank in the sky and dives down to a field or lake, the observer can spot certain distinctive traits: a white face patch around the base of a pinkish bill, a white belly splashed with black and a laughing, yelping "kah-lah-a luck" call. Although "specklebellies" or "laughing geese" are fairly common in certain parts of North America, most people don't realize there are actually three subspecies of whitefronts.

With good reason, the term "subspecies" is confusing to the nonscientist. A *species* is commonly defined as a living population of about the same structure, size, color, behavior and habitat that breeds with each other rather than with members of other similar groups. In contrast, *subspecies* are geographic races, or fractional populations, of species that differ only in inconstant and overlapping size measurements and intensity of color. They are labeled with a three-part scientific name. For example, most of the white-fronted geese in North America belong to a tundra subspecies, *Anser albifrons frontalis;* this subspecies shows definite

Sandhill Crane

variations in color, size and behavior when compared with another white-fronted subspecies, *Anser albifrons gambelli.* The latter breeds in the willow scrub of the taiga east of the mountains along the northern Alaska-Canada boundary.

To most, the minor distinctions that separate these two subspecies are negligible and they call both

continued on page 27

A Falcon of Superlatives

by Vince Yannone
painting by Steve Aller

THE American kestrel is Montana's falcon of superlatives.

First, it is the state's smallest falcon, with a body about 8½ inches long and a wingspan of 21 inches.

Second, it is the falcon most often seen in Montana, partially because it is one of the most abundant. It is often spotted flying over highways, in lightly forested areas or in cultivated fields bordered by trees or telephone poles that provide lookouts.

Third, this pretty little falcon is probably the easiest of all falcons to identify because of its method of hunting. One rarely observes a

The American kestrel has the greatest color differences between sexes of any American bird of prey. The male (right) has a bright cinnamon red back and tail, while the female (left) has a dull chestnut back and a tail banded with black. Note the blue-grey wings of the male and the reddish wings of the female. Both have distinctive black and white faces and two whiskerlike markings on each side of their faces. The female here is immature, but immature kestrels have the same coloring as adults of the respective sexes, an exception to the plumage of other birds of prey.

kestrel for more than a few minutes without noting its habit of hovering, stationary in the air, sometimes with tail pumping up and down and wing tips quivering, while it searches the ground below for possible prey.

Finally, it has the greatest color differences between sexes of any American bird of prey. The male has a bright cinnamon red (rufous) back and tail; the female has a dull chestnut back and a tail banded with black. Males have blue-grey wings, while those of the female are rufous, or a little duller. Both sexes have black and white faces and whiskerlike markings on each side of their faces.

Strictly speaking, kestrels make no nests. In wooded areas, they might choose abandoned nests of magpies or crows. They frequently use old nesting holes of flickers or other large woodpeckers. If woodpecker holes aren't available, they set up residence in the holes formed by the breaking away of heavy branches. Many pairs choose the solitude of old buildings, ruins or church towers. At the Warm Springs Game Farm in Montana, a pair of kestrels nested every year for three years in the same nest box.

Females produce from three to five oval eggs. The eggs vary in color from light tawny-yellow to almost black and they are spotted with red-brown blotches; in some cases, much of the egg remains white. As Francis Charles Robert Jourdain wrote in Arthur Cleveland Bent's "Life Histories of North American Birds of Prey": "In some cases a great deal of the white ground is visible, and when the markings are rich bright red, or are concentrated in large blotches, they form very striking and effective contrasts." The eggs are not laid on consecutive days, but at intervals of 48 hours. The female does most of the incubation and it requires about 28 days. The male supplies the female with food during incubation and if she leaves the nest, he takes her place.

Kestrels raise one brood per year. When the young hatch, the female feeds them food brought by the male. After two to three weeks, both parents begin bringing food to the nest, once each hour from daybreak to evening. When the young are about a month old, they are able to fend for themselves.

The kestrel feeds principally on mice, large insects and birds. It may even attack birds as large and heavy as itself. But, comparatively, it kills few birds and its other name, "sparrow hawk," is really a misnomer. In late summer, its food preference turns to grasshoppers.

The kestrel hunts from an elevated perch; after food is sighted, the falcon flies out to seize its prey. Its stationary holding pattern is so effective that it looks as if it were suspended from a string. It will remain in one area, watching the grass intently, until a mouse or other prey comes far enough from cover to be caught.

It has few enemies in the wild. Crows, ravens and other birds of prey may take an occasional kestrel. But threats to its nesting sites from man's land-clearing and tree-cutting activities pose a more serious threat than its natural enemies do.

Montana has 33 species of birds of prey—or raptors—of which the American kestrel is one. They are divided into 19 day-flying (diurnal) species and 14 night-flying (nocturnal) species. Falcons, hawks, ospreys, eagles and turkey vultures fly during the day, while most owls fly only at night.

Of the diurnal birds, the falcons are perhaps best known and four species besides the American kestrel live in Montana: gyrfalcon, peregrine falcon, prairie falcon and merlin (also called "pigeon hawk"). All have long, pointed wings and slender, long tails which contribute to their outstanding flying skills and their reputations as the speed demons of the raptor world.

Its speed and small size have made the "daring little" falcon's lightness and quickness "appealing." Writing in 1913, John Gripper Tyler described the kestrel: "What appeals to us most in this daring little falcon is its lightness and quickness—the speed of lightning compared to the crash of thunder. Whether dashing past with sweeping wing beats, each wing beat carrying it far away; whether cruising along—the tail folded thin and the sharp wings, like a three-pointed star—the wings barely trembling, like the tips of oars just touching the water; or whether soaring against the sky, with tail fanned out, the wings stretched wide, it is always ready to veer like a flash, to mount higher, to drop to the ground, or to come to rest on a little twig."

Smallest may mean the American kestrel flies harder.■

Pollen Analysis: A Trail Back Through Time

by Lynn Brant

POLLEN GRAINS in the sediments of a marsh have a story to tell: They reveal the history of the pond, as well as the history of the vegetation from surrounding areas.

In western Montana, areas once covered by glaciers now harbor many ponds and lakes. You will also see many marshes which appear as flat clearings in the forest, covered by grasslike vegetation part of the year and sometimes even covered by a little water.

These marshes have common characteristics, but each is also unique. Two ponds next to each other may have followed quite separate paths to their present state. What factors determine how an individual body of water develops? Size, shape, depth, elevation and living things all play a part, as does the type of rock on which the pond rests and the nature of the drainage basin above it. Although we are likely to think of ponds and lakes as permanent parts of the landscape, they are usually short-lived on a geologic time scale.

What things then determine how an individual body of water "comes to its end?" Some lakes or ponds end when their outlet streams erode and the water drains out (think of a man-made stock pond, for example). Other lakes fill—some rapidly, some slowly—with sand, gravel, mud and the remains of organisms growing in and around the water. Within the sediment which fills these ponds and lakes are pollen grains which have been deposited with the mud and other organic substances. The study of these microscopic grains is called "pollen analysis" and it is a specialty of the science of *palynology*.

Some kind of coring device is usually used to obtain sediment samples from the bottoms of lakes, bogs, marshes, etc. I prefer a length of three-inch aluminum irrigation pipe fitted with a piston. In a marsh in the mountains south of Helena which I studied, I was able to core to about 28 feet.

The palynologist then puts the sediment through a number of strong chemicals which destroy most of it, but leave the pollen grains undamaged. A typical pollen preparation is a dazzling display of bizarre shapes, textures and recognizable objects. Charred cells of wood, algal colonies, insect parts, egg cases, gossamer sheets of unknown origin and many more sights delight the eye and challenge the mind. Most of the objects originated in the water so they provide additional clues to the pond's history.

To explain a bit, pollen grains are produced by flowering plants and conifers. Other plants, such as ferns, produce spores. Both pollen grains and spores play a part in plant reproduction and their accumulation in the sediments underlying bodies of water is purely accidental.

A really big grain of pollen—such as that of fir—might measure four- or five-thousandths of an inch in diameter. Even so, each grain contains from two to several cell nuclei within living material. The whole living mass is enclosed within a nonliving container called the *exine*. The exine has air-filled bladders, spines, knobs, grooves, pores or other features which a palynologist can use to identify a specific kind of pollen.

Plants such as conifers, grasses, many trees and species with inconspicuous flowers are the groups usually represented in pond sediments. Because their pollen grains are distributed by the wind, they are widely scattered. (For the same reason, these are also the plants that provide great grief to hay fever sufferers.) Tulips, roses, daisies and other plants with showy flowers usually depend on insects for pollination; thus, they produce less pollen because each grain has a greater chance of reaching another flower via an insect or other animal.

To unravel a pond's history using pollen analysis, the palynologist must compare the relative amounts of various kinds of pollen in the different layers of sediment. The oldest sediment layers are those just above the original floor of the pond and the pollen in those layers *indicates* the kinds of plants growing in or near the pond when the layers were formed. Differences in the abundance of pollen in the younger and younger layers *indicates* changes in the kinds of plants growing at those times ("indicates" because some pollen could have been washed out of older sediments or could have been carried great distances by wind or water to the site).

These changes in the plant communities reflect climatic change, changing environments in the pond as it filled up or even changes in land uses. For example, corn pollen in lake sediments can help modern scientists learn about the presence of certain Indian cultures; appearance of pollen in North America from weeds originally growing only in Europe marks the arrival of early-

day European settlers.

Most pollen in a pond's sediments comes from within a few hundred yards. Except rarely, however, a palynologist cannot tell the origin of a particular pollen grain when seeing it through a microscope. One of these exceptions is the pollen of Mormon tea *(Ephedra)*. Although this plant grows mostly in the Southwest, I found a few grains in my study of the marsh near Helena. Mormon tea pollen has also been found in the Great Lakes region more than 1,000 miles from Helena.

Shoreline conditions are indicated by pollen from the vegetation growing there, such as sedges (grasslike plants), cattails and alder.

Most information about the pond itself comes from the pollen and other parts of aquatic plants found in the sediment. Even insect-pollinated flowers such as the yellow pond lily *(Nuphar)* contribute pollen because the flowers occur in or at the water's surface. Conspicuous flowers are usually poorly represented in the pond's sediments. For example, although beargrass is abundant near the marsh I studied, only three of the 40,000 to 50,000 grains I counted could have come from beargrass.

I found rock flour—ground-up rock of a bluish-grey color—at the bottom of the core sample. When the rock flour was deposited, the marsh was a small, cold pond. This sediment was produced as a glacier (probably

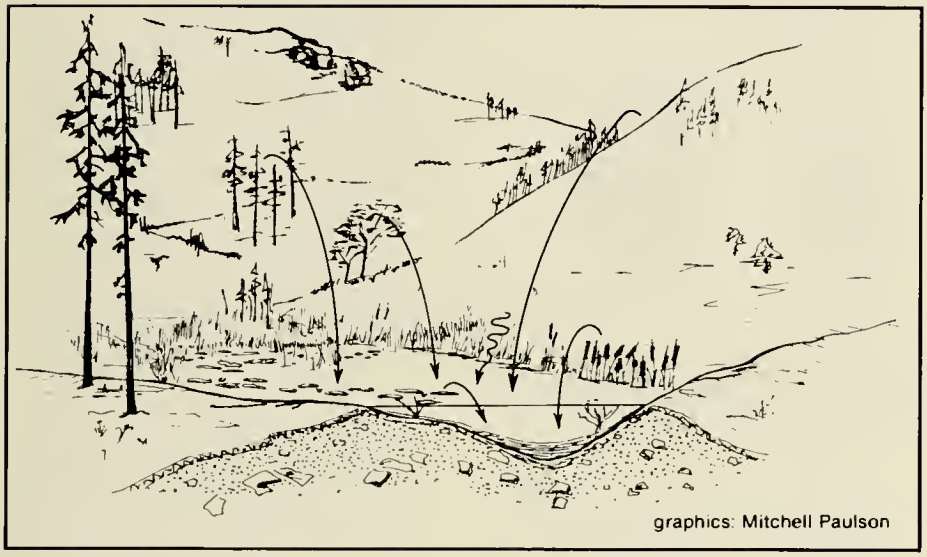


Figure 1—Sources of pollen in pond sediment

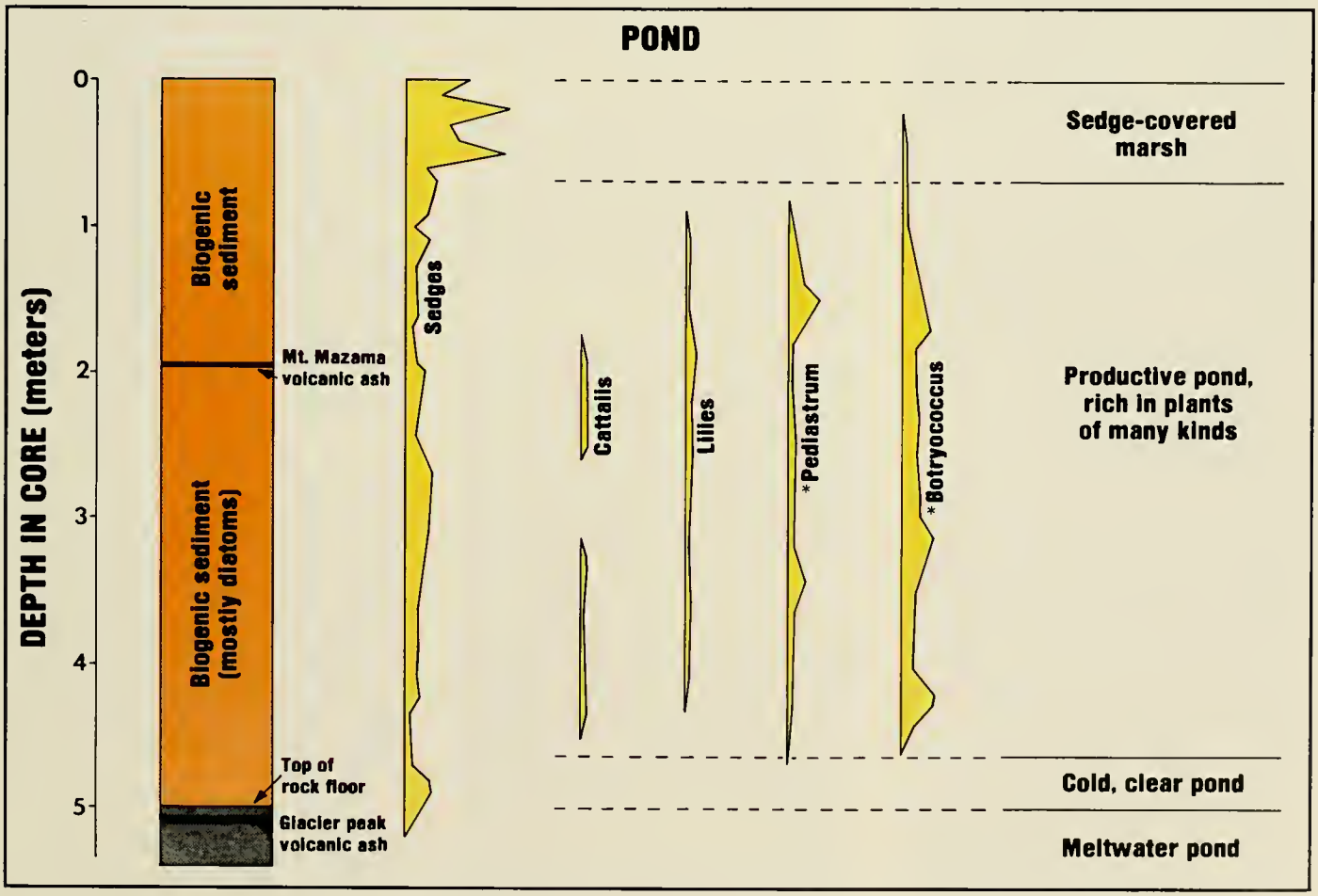
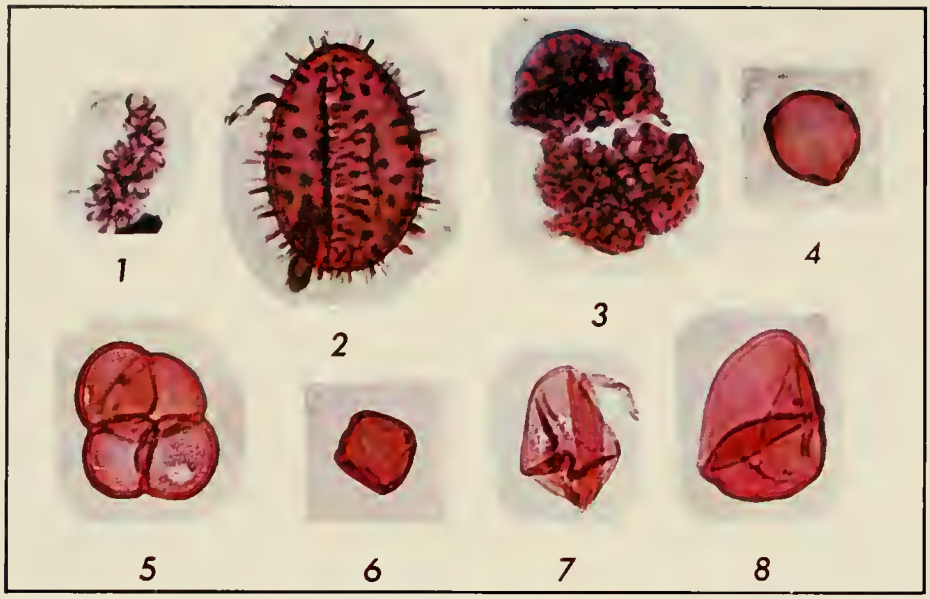


Figure 2—Partial, simplified pollen diagram (*two kinds of algae that live in open water)



Examples of plant remains in a pollen preparation: (1, 3) colonies of *Botryococcus*, an alga; (2) yellow pond lily pollen; (4) birch pollen; (5) cattail pollen; (6) alder pollen, and (7, 8) sedge pollen.

the one which formed the pond) melted.

Near the top of the rock flour, I found a layer of volcanic ash, which was probably produced by the eruption of Glacier Peak in northern Washington about 12,000 years ago. Considering the association of the ash and the rock flour, we can conclude that the last Ice Age in the mountains south of Helena ended about 12,000 years ago.

Some of the pollen in the first-formed layers came from plants generally growing above tree line. The climate which produced the glaciers also caused the tree line to move downward, and I suspect some of the intermountain valleys—which are now rangeland—were forested, as the mountains are today.

As the climate warmed, the tree line moved up the slopes and forest eventually covered the land around the pond. The fossil pollen reflects this vegetational change. This early forest, established 10,000 to 11,000 years ago, had abundant lodgepole pine and probably was similar to the type of forest now at the site. Small pieces of charcoal in the sediment suggest forest fires have been part of the environment for a long, long time.

I also found evidence of dwarf mistletoe, a parasitic plant that weakens conifers and is considered in the same class as disease and fire by the commercial forester. It, too, has been present since the forest first occupied these mountains.

If nature abhors a vacuum, she doesn't care much for sterile ponds either. Soon after the body of water was formed, aquatic plants became established. Diatoms—a group of algae—were living there before the rock flour had settled.

Although present throughout all layers in the sample, sedge pollen becomes much more abundant only near the top (in the youngest layers). On the other hand, pond lily pollen is never very abundant and it is absent in both the oldest and youngest layers.

To interpret their data, pollen analysts usually plot their findings on a pollen diagram. Where that type of pollen is abundant, the resulting figure is "fat," and it is "skinny" where the pollen type is less abundant. Figure 2 is an abbreviated and simplified version of the pollen diagram for the marsh near Helena.

The pond has gone through four distinct phases in its evolution. As the glacier began to melt and fill the pond, it dumped sand and rock flour into the depression. The bluish-grey color of the rock flour probably gave the pond a turquoise hue—like many small ponds and lakes that we find today above tree line and near glaciers.

The second phase began when the glacier had completely melted and little rock flour or other inorganic sediment was being washed into the pond. The water was probably very clear and about 20 feet deep.

The third and longest phase began about the time the yellow pond lilies started to grow. The pond was probably surrounded with lush vegetation, including cattails, and the water was dotted with the leaves and yellow blossoms of water lily. Below the surface were countless diatoms and other algae upon which insects of many kinds fed. If fish were present, they left no recognizable traces.

During this third phase—about 6,700 years ago—a volcano erupted in Oregon. Mount Mazama blew away an entire mountain, leaving Crater Lake behind. The volcano must have erupted several times over a period of many years, leaving a layer of volcanic ash all over the northwestern United States and southwestern Canada. The May 1980 eruption of Mount St. Helens was tiny compared with Mount Mazama's eruption. The ash formed a light-colored layer in the sediment core, but there was little change in the pollen because of this fallout of ash. We can tentatively conclude that Mount Mazama's eruption had no significant long-term effects on vegetation in western Montana.

Over the next 6,000 years, the pond became quite shallow and sedges covered more and more of the surface. Eventually, these sedges filled in the open water and eliminated habitat for pond lilies and certain algae. Thus began the fourth and present phase of the pond—now a marsh. Sedges, elephanthead, senecio (groundsel) and bog orchids now grow where pond lilies used to float and where—12,000 years ago—a glacier rested.

This marsh is not the final chapter, but rather the latest phase in its continuing evolution. Barring human disturbance, the small outlet stream will cut into its rocky bed, allowing the pond/marsh sediment to drain. Some trees may grow. In another 5,000 years, forest may cover hillsides and marsh alike. Or, these mountains could once again be covered by glaciers.

This is the story of just one pond. Deciphering its history by way of pollen analysis is a time-consuming task. But it's also a fascinating adventure back into time.■

Readers Respond

Pictorial Issue Dazzles Readers

Being forever a Montanan (who is now living in California), I was overwhelmed with the beautiful special issue of *Montana Outdoors*. The photos, the comments and especially the ending quote by K. Ross Toole made this ex-Polsonite extremely proud to call Montana his heritage.

Your magazine fills a special need for all of us no longer physically living in Montana, but who will always live there in our hearts.—*Bill Boettcher; Laguna Beach, Calif.*

* * * * *

Your Nov./Dec. issue is so outstanding I decided I would send it as my Christmas card. My check for $75 is enclosed. Send as many magazines as it will buy, after postage.—*C. Turner; Quincy, Wash.*

* * * * *

Congratulations! You have done it again. Your special pictorial issue for Nov./Dec. 1981 is splendid.

I am proud to have had an article published in your magazine earlier this year (see "Some Nuggets Panned from Boone & Crockett," March/April 1981) and enjoy reading each issue.

My check for $6 is enclosed and I would appreciate it if you would send me however many copies of your special pictorial issue that will buy.

Many thanks, and keep up the good work.—*Norman C. Roettger, Jr., U.S. District Court Judge; Fort Lauderdale, Fla.*

* * * * *

I just received my Nov./Dec. pictorial issue. It is so beautiful and outstanding that I cannot find adequate words to say thank you for sharing all of its splendor. Everyone involved in the publication is to be commended.

The photos of Danny On's brought tears, remembering all he gave us. I'd like a special thanks to go to Jon Cates for the bighorn sheep group.

Here's my check for 12 more copies to share with appreciative friends at Christmas and so I can tell them about *Montana Outdoors.—Frances Hindman; Salem, Ore.*

* * * * *

I just received the Nov. /Dec. *Montana Outdoors*. It is outstanding. The photographs are superb and the layout/design is excellent. It should be an award winner.—*Bob Davis, coordinator, National Hunting & Fishing Day; Riverside, Conn.*

* * * * *

Until receiving the Nov./Dec. issue of *Montana Outdoors*, I had decided not to renew my personal subscription, although I did purchase a gift subscription for the Committee on Nature Preservation of the Azerbaidzhan Soviet Socialist Republic, USSR, hoping that your excellent publication would give them a model to follow. Today, after many years of working for nature conservation, I was beginning to feel a little apathetic.

But seeing the beauty you've captured in this month's issue actually brought tears to my eyes and made me realize that even 100 or 1,000 failures do not diminish the joy of even one success. Please renew my subscription for three more years.—*Joseph Vincent; New Orleans, La.*

* * * * *

Your Nov./Dec. edition is fantastic. It makes me want to start another crusade for preservation of the beauty of our state. Let's have more issues like it. I hope 20 years from now I can look at this issue again and be able to say: It's still the same.—*Mrs. Bill Purkett; Havre, Mont.*

* * * * *

What a great issue! Truly wonderful. Please send as many copies for the enclosed $15 as you can. I want to give them to personal friends and put them in rest homes, doctors' offices, etc.

We still love Montana and get back to the Bitterroot and the Judith Basin country as often as we can.—*Larry Roumpf; Baker, Ore.*

* * * * *

I just saw a copy of your very fine magazine at a friend's house. I would dearly love to have a copy of your Nov./Dec. edition.

If this issue is typical of your excellence, *Arizona Highways* better watch out.—*Robert L. Lund; Detroit Lakes, Minn.*

* * * * *

The special issue of *Montana Outdoors* is the most beautiful collection of pictures we have ever received—and we are senior citizens.

If there is a favorite, it is the elk by Mike Logan. Most unusual are the two by Peter Kagan of the dragonfly and skiing, and the nighttime scenic by Paul Dix.

My hobby is painting animal pictures in oils and I can hardly wait to finish my lion and start that bighorn sheep family by Jon Cates. The bighorn lamb by Danny On will never be repeated—it is one of a kind. I am so glad there were other Danny On pictures.—*Mrs. A. Anthony; Coeur d'Alene, Idaho*

* * * * *

With reference to the Nov./Dec. 1981 issue of *Montana Outdoors*, I draw your attention to page 7 and the Buckminster Fuller quote: "The most important fact about Spaceship Earth: An instruction book didn't come with it."

Now I have no idea who Mr. Fuller is, but obviously he has never read or heard of the instruction book for our great earth. It's called the Bible.—*Jack Watteyne; Lakeside, Mont.*

* * * * *

Enclosed is my check for $25 to cover the cost of 25 copies of your magnificent special photographic issue promoting the need for the natural world.

I will use these as special gifts to horticultural acquaintances of mine.—*Ed Markham; Kent, Wash.*

Deer-Dog Friends

I am writing to relate an interesting and unusual wildlife observation made on Sept. 2, 1981 at 8:30 a.m. at Rainbow Ranch north of Melrose, Mont.

While visiting the mobile home summer residence of Richard G. Jones at Rainbow Ranch, three of us were in the kitchen making coffee and watching white-tailed deer on the far side of the pasture, as we did each morning.

Suddenly, a young four-point mule deer in velvet appeared inside the fenced yard. He was standing about 10 feet away, quite relaxed, next to the car. This in itself was unusual because the whitetails never come near the mobile home.

Upon further observation, we saw a large, rust-red, heavily furred male dog "making the rounds" of the yard,

while the deer stood and watched him. After a few minutes, the deer trotted to the gate, stopped, turned, looked at the dog and waited.

The dog then joined the deer and the two trotted off down the road, side by side. Each time the dog stopped to "investigate" a clump of grass, the deer stopped and waited. Then the two proceeded out of sight.

There were three cameras within reach, but we were so intent on watching this unusual relationship that we failed to take a picture!—*Col. Bob Brooking; USAF Ret.; Austin, Tex.*

"The Best Things In Life *Are* Free"

Following is a poem I thought you might possibly like to print in *Montana Outdoors*. Ever since that memorable day, May 18, 1980, I have been attempting to complete this nature-inspired poem:

The Best Things in Life *Are* Free

When Mount St. Helens blew her top,
It was very plain to see,
With all the riches in the world,
The best things in life *are* free.

The air we breathe, the water we drink,
Are often overlooked,
But we were made to stop and think,
The day St. Helens shook.

We must learn to appreciate
The finer things in life,
To never underestimate
What we, through God, derive.

For we can never ere replace
The mountains and the trees,
The valleys and the cool, clear lakes—
What have we, if not these?

Our wildlife, more precious still,
Delightful to behold,
Bring wonderment to all mankind,
From young to very old.

Our childrens' health and welfare,
A clean environment,
Is all that really matters,
The real requirement.

For a satisfying life
Of inner joy and peace,
We must escape from strife,
Anxieties release.

And so I'll say it one more time,
In hope you will agree,
With all the riches in the world,
The best things in life *are* free.—
Susan M. Appelt; Huson, Mont.

Taking Care Of Our Own

We live in the Missouri River Breaks, along Fort Peck Reservoir northwest of Jordan. So the deer graze in our fields and we have seen elk in the fields north of our house. Wild turkeys are in our fields year-round and grouse and pheasants eat the berries from my Russian olive trees.

Also, a pair of Canadian geese come every year with their young and live on the reservoir, right by our house. We feed them some, too. We trap and shoot fox, coyotes, mink and skunk, which kill fawns, goslings and everything else around here. Also, I have peacocks, domestic turkeys, chickens and geese which I have to shut up at night for their own protection. We had ducks, but foxes came right into the shed and got all six of them. We also keep some sheep and cows.

We don't get into you guys' battles. We take care of our own and have a very peaceful family.—*Mrs. Emmett Clark; Brusett, Mont.*

Texan Pays Attention

As a free-lance public relations man and writer, I want to congratulate you for the great job of editing, writing, photography and printing enjoyed by the readers of *Montana Outdoors* magazine.

A subscription was given me a couple of years ago by my son and daughter-in-law who moved to Bozeman from Decker to do graduate work at Montana State. She received her Master's in teaching in June, and he is nearing his in wildlife management while also doing extensive field research in Yellowstone and elsewhere. They're also dedicated to indoctrinating their 5-year-old son into the splendors of your magnificent state—and in urging their Dallas kinfolk to hurry up there and see what they've been missing.

Meanwhile, we regularly visit Montana vicariously through the pages of your beautiful publication.

...Thought you'd like to know there's someone down here in Texas who's paying attention.—*Al Harting; Dallas, Tex.*

Flashes on the Horizon

How I love the title of your magazine! I grew up on the Yellowstone and love every curve and quirk of her twisting and turning.

Several years ago, I did quite a bit of writing. I'm alone now. My husband passed away in 1960 and our six boys are all married with families of their own. I've enjoyed all the 18 grandchildren and now 10 great-grands and I still love to write about the family. They have been a marvelous experience.

I've just read the latest issue of *Montana Outdoors* with the marvelous story or explanation of "Flash & Fury in the Sky" (July/August 1981). We are in the middle of these things right now and I watch each display with my "hair on end." I always have chills running down my "spine" at what I see and hardly understand. But God's masterpieces are forever flashing on the horizon. Why go to theaters when I can watch for free these marvelous sunrises, sunsets and all of the changes in nature's moods.—*Mary L. Lowry; Savage, Mont.*

* * * * *

In summer 1981 I worked as a fire lookout on Saddle Mountain, about six miles east of Drummond, Mont. Don Fuquay's "Flash & Fury in the Sky" gave me and my family a lot of new and additional information which was of help on Saddle Mountain and in our everyday lifestyle.

All of the articles in *Montana Outdoors* have been very informative and educational to everyone in my family. The pictures are of the best quality

Get It Together

And keep it together with a fine-looking *Montana Outdoors* binder. A full year of magazines in one place, protected, and at your fingertips.

The binder—handsome, leatherlike, rich brown with gold lettering—features easy-to-insert metal rods that secure each magazine. What a bargain at $5.

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For each personal or gift order, send $5 to: *Montana Outdoors,* Department of Fish, Wildlife and Parks; Helena, MT 59620.

I have ever seen. In other words, we enjoy the beauty of nature and your pictures bring that out.

We are very much believers in conserving our natural resources and using them wisely. *Montana Outdoors* articles reflect where we are and what we have to do to save the natural beauty of Montana.

Thank you so much for a magazine that will give my family pleasure for many years to come. The staff needs to be commended for a job well done.—*Paul E. Jacobsen; Deer Lodge, Mont.*

* * * * *

Members of St. Vincent Hospital and Health Center Burn Team read Don Fuquay's article, "Flash & Fury in the Sky," with great interest.

One of our primary goals is to build public awareness of fire hazards and potential burn-causing elements. Mr. Fuquay did a superb job of describing how to apply lightning behavior and body responses to personal safety.—*Gayle Wood, R.N., nurse clinician, St. Vincent Hospital; Billings, Mont.*

An "Altogether Effort"

I have hunted and fished in my native Montana ever since I was knee high to a grasshopper. There is no place in the world that contains the natural beauty, abundant resources, magnificent wildlife and friendly people. I am in the U.S. Army, stationed in Germany, and I have had the opportunity to travel this area extensively. I have hunted here in Germany and fished in Switzerland and the Scandinavian waters. These areas indeed contain their beauty, but nothing can compare to the Treasure State.

I come home every day and look for my newest copy of *Montana Outdoors*, so I can catch up on environmental issues, wildlife status and informative articles. I have only a year left here and upon completion of my tour, I will be home where I belong—in Montana.

I wish to commend you on the fantastic articles, photos and the altogether effort to retain Montana's wildlife and resources.—*Scott Zeitner, Burtzbach, W. Germany*

Success Story

As you will see before this little note ends, I am one proud Oakie. I had the good fortune the first week of October to take my first elk hunt in your beautiful Bob Marshall Wilderness. Call it luck or whatever, I got a fine five-point bull the first day.

The outfitter did one heck of a job and I did not want for one thing more. My guide was a credit to his profession, and he gets lots of credit for my good luck.

As an out-of-state hunter, let me say your license fees are fair, but please don't price us nonresidents out of the chance to hunt in your state.

I hope to repeat this hunt again in the near future. I enjoyed every minute of the eight days I spent in Montana.—*Truman Latting; Tulsa, Okla.*

Montana Outdoors Index

The major items published in *Montana Outdoors* in 1981 are indexed below. Extra copies of all 1981 issues are available at $1 each.

The following back issues are no longer available:

- 1970, 1971—entire years
- 1972—Jan./Feb., March/April, May/June
- 1973—Jan./Feb., March/April, May/June, July/August
- 1975—July/August, Sept./Oct.
- 1976—Jan./Feb., March/April, Sept./Oct., Nov./Dec.
- 1977—Special Yellowstone Issue
- 1978—May/June, Sept./Oct.
- 1980—July/August

Other issues are available in varying quantities at $1 per copy. Order from: Back Issues, *Montana Outdoors*, Department of Fish, Wildlife and Parks; Helena, MT 59620.

BOOKS REVIEWED

The Wild Palate (A Serious Wild Foods Cookbook), by Walter and Nancy Hall (Jan./Feb. 1981).

Montana, by Russell Lamb (Jan./Feb. 1981).

Packin' In on Mules and Horses, by Smoke Elser and Bill Brown (Jan./Feb. 1981).

The Hiker's Guide to Montana, edited by Bill Schneider (March/April 1981).

Moosewood Cookbook, by Mollie Katzen (March/April 1981).

Photographing the West, a State-by-State Guide, by Erwin and Peggy Bauer (July/August 1981).

Fishing the Headwaters of the Missouri, by Norman Strung (July/August 1981).

A Brush with the West, by Dale Burk (Sept./Oct. 1981).

Wildlife Drawings, by Charles W. Schwartz, edited by Michael McIntosh (Sept./Oct. 1981).

DEPARTMENT

The Director's Column—A discussion of the department's financial situation (Keith Colbo, Jan./Feb. 1981).

The Editor's Column—The natural role and ecological significance of fire (Dave Books, March/April 1981).

Overview—The department's role in water resources management (Art Whitney, May/June, 1980).

Overview—Directing change into positive channels, and assuring that the Montana way of life isn't threatened by it (Dave Books, July/August 1981).

Meet the Commissioners and the Director—The Catchall (July/August 1981).

Overview—Consider the landowner: The future of Montana's hunting opportunities lies in his hands (James W. Flynn, Sept./Oct. 1981).

Overview—The value of wild things in wild places (Editors, Nov./Dec. 1981).

FISH/FISHING/WATER

Leave Your Watch at Home—Adventures of a fly fisherman turned ice fishing specialist (Jim O'Loughlin, Jan./Feb. 1981).

Living Water—Without life, there would still be water; without water, no life (David Quammen, May/June 1981).

Fisheries Management—"Special Regulations for Larger Trout: Is Montana Ready?" by Ron Marcoux, "Lake Population Census: Sounding Out Secrets" by Laney Hanzel, "Electrofishing: Using Current to Count" by Dick Vincent, "The Role of the Hatchery: Then and Now" by George D. Holton, "Underwater Census: The Waterproof Biologist" by Patrick Graham (May/June 1981).

The Saga of Old #134—The story of a long-lived brown trout in the Big Hole River (Jerry Wells, May/June 1981).

Identification of Montana's Most Common Game and Sport Fishes—An eight-page color guide (George D. Holton, paintings by Glenn West; May/June 1981).

Water, Water Everywhere, But...—Sometimes the biggest challenge is gaining access (May/June 1981).

1980 Fishing Records Summary—Three records fell (May/June 1981).

Alpine Lakes: Fish Among the

Clouds—Montana's high country offers a wonderland of alpine lakes (Pat Marcuson, May/June 1981).

Spring Creeks: Montana's Fragile Fishery—Another type of wild trout resource about which one hears little (Jerry Wells, May/June 1981).

Warm-Water Fisheries—"Prairie Gold Mine" by Al Elser, "The Walleye of Fort Peck Reservoir" by Jim Liebelt (May/June 1981).

Bright Spot in Stream Management—Stream inventories provide the information necessary for sound stream management (Tom Ganser, May/June 1981).

Needs in the Life of a Fish—Water quality, water quantity and suitable habitat (Ken Knudson, May/June 1981).

Search for Sauger—How important are spawning areas in the Tongue and Powder rivers to overall sauger production in the Yellowstone River? (Russell F. Penkal, July/August 1981).

Worthy of "Extra Special Concern"—A report on the status of Montana's stream-dwelling grayling populations (Norm Peterson, July/August 1981).

Battleground at Prickly Pear—A boy, and a creek, and the pains and challenges faced by each in growing toward maturity (Charles Wood, July/August 1981).

Social Conflict on the Madison—The problem is more than limiting the number of fish that a fisherman can take (Ron Marcoux, July/August 1981).

Water Wolf of the Weed Beds—When it comes to demolishing fishing tackle and turning an angler's hair grey, the northern pike is at the top of the list (Ken Walcheck, Sept./Oct. 1981).

GAME/HUNTING

Age Determination of Wildlife: The Art and the Science—Sex and age data provide biologists with valuable information (Ken Greer, Jan./Feb. 1981).

The Question of Game Farms—An interview with the administrators of the department's Wildlife, Ecological Services and Law Enforcement divisions (Gene Allen, Jim Posewitz, Erv Kent; Jan./Feb. 1981).

How to Talk Turkey and Avoid Eating Crow—Many spring gobbler hunts end up with far more tales than turkeys (Ken Walcheck, March/April 1981).

Big Horn Game Ranch Hunt—Department personnel monitored a mule deer hunt within nearly 30 square miles of fenced land on the Big Horn Game Ranch (Jon Swenson, March/April 1981).

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Nongame Update—The Catchall (Dennis Flath, July/August 1981).

Iridescent Beauty—Profile of the wood duck (Jeanette Hortick, Sept./Oct. 1981).

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Lewis and Clark Caverns: A Showcase of Nature's Forces—The sea, the mountains and the water combined to create one of Montana's most intriguing attractions (Richard B. Aram, March/April 1981).

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Born With a Feather In His Mouth *continued*

groups "white-fronted geese." Taxonomists (biologists who classify plants and animals according to their presumed natural relationships) can be grouped into "subspecies" too: the "splitters" who delight in classifying birds and other animals according to minute differences, and the "lumpers" who differentiate on the basis of larger distinctions. Nobody has much disagreement in trying to distinguish between a turkey and a hummingbird, for example; but differences arise quite readily when the differentiations are between species and subspecies. And the white-fronted goose subspecies controversy was no exception, as Bob Elgas found out.

THE POSSIBILITY of the tule goose as a distinct subspecies of white-fronted goose was raised in 1917 by two University of California researchers, Harry S. Swarth and Harold C. Bryant, who compared the tule goose and *A.a. frontalis* in certain parts of their California habitat. They wrote: "The two kinds flock separately, for the most part; the larger race [tule] is never seen in such big flocks as is customary with the other, but is most frequently noted singly or in pairs; also that while the smaller variety [*frontalis*] is a common frequenter of grain fields and uplands generally, the larger one is pre-eminently a denizen of open water or of ponds and sloughs surrounded by tules and willows. The predilection of the latter species for such localities has given rise to the local names by which it is known, 'tule goose' or 'timber goose' as contrasted with the upland-frequenting 'specklebelly.' "

Later, observers noted other differences in the tule goose when compared with the *gambelli* and *frontalis* subspecies: a slower wing beat; a harsher, more sonorous "yelp"; more reclusive behavior; a denser black color, and larger with longer legs and neck. More subtle differences were further documented by Elgas and other researchers.

Despite the accumulating evidence which alluded to a third subspecies of white-fronted goose, most biologists doubted its existence and lumped it into the *gambelli* classification. Elgas wasn't convinced, however. He began corresponding with others interested in white-fronted geese. In addition, he acquired researcher James Moffitt's notes on white-fronted and tule geese in central California.

During summer 1964, with financial aid from the World Wildlife Fund and the International Council for Bird Preservation, Elgas and fellow aviculturist, Jack M. Kiracofe, flew to the Mackenzie River Delta in the Yukon and began searching for the breeding grounds of the tule. They eventually captured and banded 50 birds they thought were tule geese and sat back to wait for band returns. Elgas expected the geese would return to the Sacramento Valley to winter. But band returns from northern Mexico, Texas and Saskatchewan—in addition to taxonomic measurements of the captured birds—strongly suggested the birds instead had belonged to the *gambelli* subspecies. Location of the tule goose nesting grounds remained as much a mystery as ever.

IN 1970, Elgas decided on a different strategy. After receiving permission from the U.S. Fish and Wildlife Service (USFWS), he traveled to the Sacramento National Wildlife Refuge to continue his research. He gathered additional information and found more clues to the puzzle. Despite mounting evidence that the tule goose was a separate subspecies, there were still doubters. "To some, it was a big joke," Elgas said. "They would come into the refuge office and after being introduced to me by the refuge manager, they would say, 'Oh! You're the guy out here looking for those super geese.' "

Before a taxonomist can draw valid conclusions, he must have specimens with which to work. The adage of "a bird in the hand is worth two in the bush" definitely applied. Capturing live tule geese was a major undertaking for Elgas and it took three frustrating years before he was successful. Tule geese on the refuge fed on millet and the tubers of bulrushes in shallow impoundments. Because of their aquatic feeding habits, they could not be baited and captured by nets shot from field cannons. On one occasion, bean geese, similar in size and color to tule geese, were used for decoys. The trappers watched 12 tule geese apply aerial brakes and drop into the live decoys. "We had everything set," recalled Elgas. "Everyone's heart was pounding, and when we pushed the detonator switch, the number-one cannon on the boat was the only one that fired and, of course, all the geese flew away. I became convinced Lady Luck had a perverted sense of humor, and more than once I roundly cursed her fickle ways."

Persistence and patience eventually paid off and eight tule geese were captured. Dick Bauer, then resident wildlife biologist at the Sacramento refuge, evaluated the taxonomic differences. The birds were then sent to the USFWS Patuxent Wildlife Research Center in Maryland. After careful deliberation, Dr. John Aldrich and center staff members concluded there was little doubt the tule goose was a distinct subspecies of white-fronted goose.

In 1975, the American Museum of Natural History published a paper, "Descriptions of a New Subspecies of the White-Fronted Goose, *Anser albifrons*." Authors Jean Delacour and Dr. S. Dillon Ripley provided a very detailed description of the subspecies of white-fronted goose and concluded: "We are convinced that west of the mountain ranges there is a distinct, larger, darker, whitefront population that is separable from the form described above and properly known as *gambelli*." They further concluded that the mountains along the northern Alaska-Canada boundary served as a physical barrier that separated the tule subspecies from the taiga subspecies, *gambelli*.

In the scientific world, the discoverer of any new species or subspecies is usually honored by having his name included in the taxonomic classification; Delacour and Ripley selected *Anser albifrons elgasi* as the name for the new subspecies. They wrote: "Named in honor of Robert Elgas who has for some time conducted an active survey of these geese and endeavored to find their nesting grounds."

Clarifying the taxonomic status of the tule goose was a major accomplishment for Elgas and his colleagues, but the last piece of the puzzle was still missing: the tule's nesting grounds.

In 1975, Elgas, assisted by personnel at the Sacramento refuge, equipped six tule geese with radio transmitters which they hoped would lead researchers to the nesting grounds. The effort failed, however, because radio signals from the telemetry units were transmitted only for short distances.

A wildlife graduate student, D.P. Connelly, picked up on Elgas' telemetry study a few years later. In spring 1978, 18 tule geese were captured, banded and radio-equipped. Even though Connelly used more sophisticated telemetry units, the marked tule geese disappeared into the Arctic wilderness. Although he tried to locate the birds, he was unsuccessful.

Despite the telemetry failures, Elgas was getting closer to that last puzzle piece. The information that trickled in continued to point to southern Alaska as the breeding grounds. Then later in 1978 Lady Luck changed her tune, when Elgas happened to see some close-up photographs of white-fronted geese taken on the north shore of Cook Inlet. "When I saw those photographs," said Elgas, "I was convinced they were tule geese."

Armed with this information, Elgas and aviculturist Warren Hancock of Billings flew to Alaska in search of the nesting grounds of the tule goose. On July 3, 1979, while flying the north shore of Cook Inlet near Redoubt Bay (about 70 miles southwest of Anchorage), they spotted a large flock of tule geese. They took many photographs of the adults and their broods and reported their discovery to the USFWS and the Alaska Department of Fish and Game. Elgas' long quest for the tule nesting grounds was finally over.

Fortified with collecting permits from the USFWS and the Alaska wildlife agency, Elgas and Hancock returned to the Redoubt Bay area and captured 10 tule geese. They were brought back to Montana for further evaluation and use in the propagation program. The goal of Elgas' work and the cooperative programs of state and federal agencies is ensuring survival of the species (the current population is between 1,500 and 2,000 birds). "Our effort," said Elgas, "is directed toward being as certain as we possibly can that a hundred years hence—just as today—those big, dark tule geese will wing their way south each fall, from their northland summer home, to winter in California."

AS WE watched the tule geese parading in front of us, I asked Elgas how Big Timber residents accepted his work. He commented there was tremendous support for his operation: "There was a time when some people thought it was ridiculous. They would say, 'Look at him. He could be raising a half-dozen more cows if he would get rid of those stupid birds.' But it's not that way anymore. I think people in Big Timber take pride in the collection. We have people constantly coming to visit, and we have an outstanding relationship with the kids in this area. They are free to come, and they do come. We have Audubon and school groups, Scouts, bird-watchers and photographers in abundance. I especially enjoy the young people because now and then you have a breakthrough and one of them gets really excited about those birds."

Elgas makes his living as an artist. His oils and watercolors hang in collections and galleries throughout the United States and in private collections in America, Europe and Asia. As one might suspect, most focus on waterfowl. Many of Elgas' paintings are now commissioned and he and the person for whom the work is done put together a product designed to fill a specific desire.

When one spends a little time with Bob Elgas, it becomes quite apparent he has an ecological conscience and is concerned about environmental issues. At the national level, he feels a strong indication has surfaced that we are going to lose some of the environmental gains made over the years. He said, "I don't like to see environmental standards relaxed when there isn't a drastic need to do so."

In Montana, Elgas believes that more purposeful strides could be made to conserve our water. He also thinks more concerted efforts should be made to acquire wetlands. When I touched on the subject of financing wildlife resources, Elgas pointed out, "We need to pay more for the privilege of hunting and fishing so there is more money to put back into the programs to sustain the resources. The price of a license is the smallest part of the expedition.

Tule Geese

"When I asked Elgas about his most significant contribution as a naturalist, he quickly answered, 'Well that would have to be my work with the tule goose.' The story he related was a fascinating piece of detective work spanning nearly two decades."

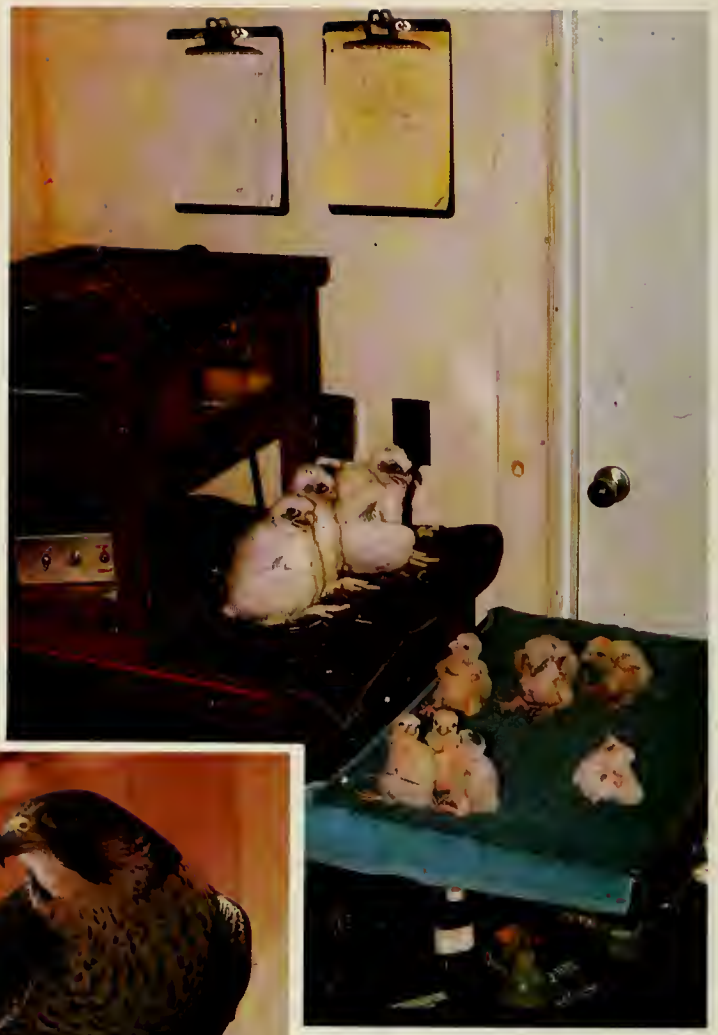
We also need to get the message out more clearly so people can better understand the needs of the wildlife resources."

AFTER LEAVING Elgas and his birds, we drove through heavy rain. Somewhere between Big Timber and Miles City, I began daydreaming about a past hunting experience. I once took a friend of the family—who knew absolutely nothing about hunting, and wasn't too fond of dogs, especially Labradors—on a duck hunt. From my corner, the hunt was a good one. The conversation was excellent, the food fine and we enjoyed some superb shooting. With one exception, we quickly filled our tickets. It had not been a good day of shooting for the family friend. He consistently missed good shots and just couldn't seem to find the right combination. Finally, he managed to wing a beautiful drake canvasback which fell into the rushes. After a long, difficult search, one of the Labs found the "can" and retrieved it back to the blind. The elated hunter picked up the duck by the neck and began stroking its head and back, mumbling something about an extraordinary experience. He finally sat down, emotionally overcome. "How long has this been going on?" he asked. "And where have I been all of my life?"

I couldn't answer those questions then. And I still can't. I do know, however, that his personal experience—like my visit with Bob Elgas—was indeed something out of the ordinary.■

Peregrine Recovery Program

A GIANT Step Toward Success



At the Fort Collins, Colo., facility of The Peregrine Fund, Inc., young peregrines are produced from captive stock for release into the wild (above photo: DFWP). Once hatched, the young birds are hand-fed until they are several days old. Then, the young are given to adult peregrines for further rearing (left DFWP photo: Dennis Flath).

by Dennis Flath

WILDLIFE management is an inexact science at best. The biological aspects are too often obscured by a multitude of social and political factors. With endangered species, the probability of resurrecting a viable population from a few remnants is even more difficult than routine wildlife management. Social and political factors may nearly overwhelm the recovery effort. Futhermore, the factors which resulted in endangered status in the first place may be nearly impossible to correct—for example, habitat loss.

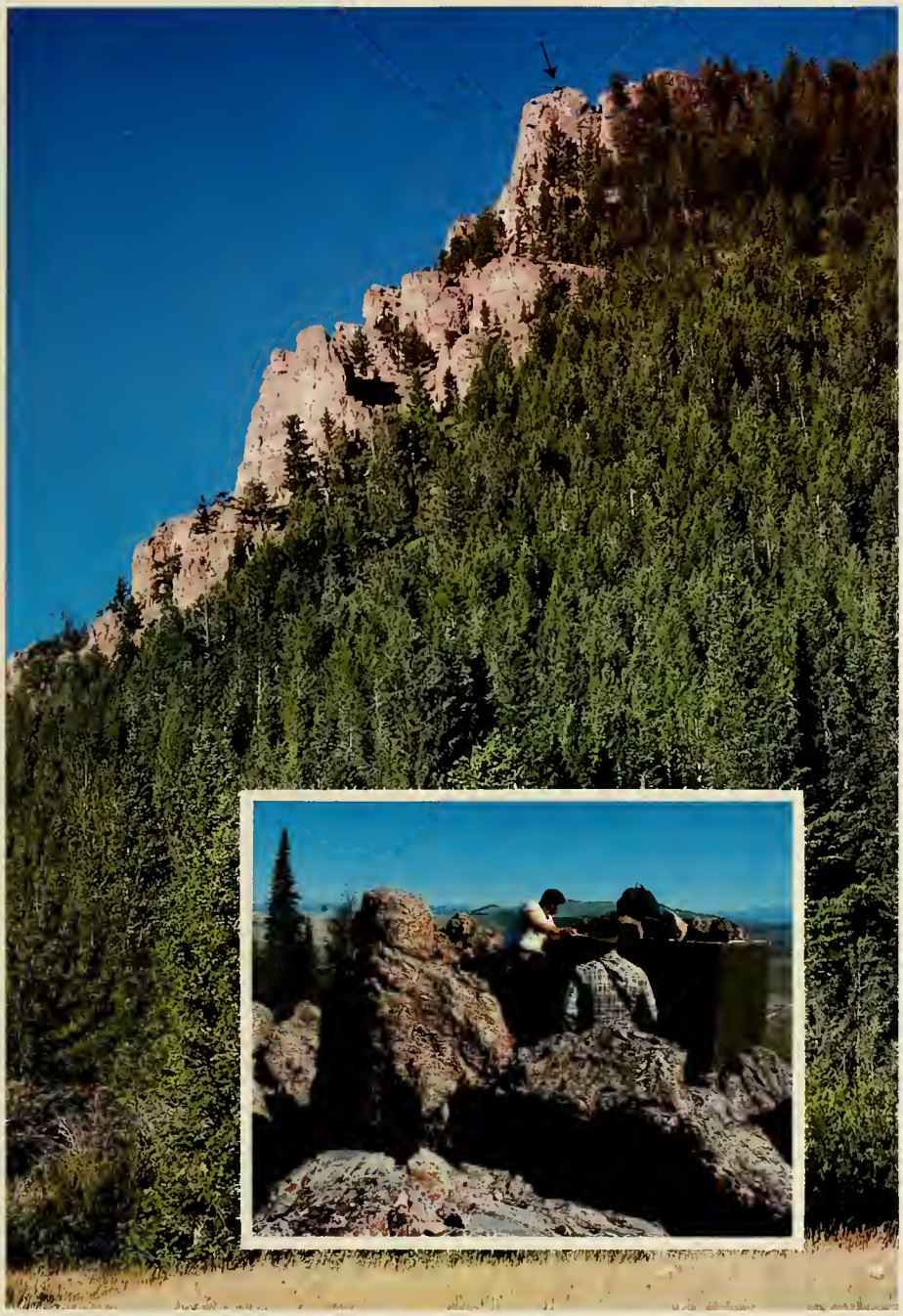
But concern for endangered species is very real in the United States, and a certain segment of the public demands restorative action for endangered species from resource management agencies. For some species, such as the peregrine falcon, prospects for recovery are bright; but for others, such as the black-footed ferret, prospects are grim.

The decline and fall of the peregrine falcon is one of the better documented cases of a modern society's failing to accept responsibility for the welfare of public wildlife resources. The peregrine falcon was well along the road to endangered status before most people had any idea it was in trouble. When the realization finally dawned that we were nearly out of peregrines, it was almost too late.

DDT had been used indiscriminately, resulting in the near decimation of peregrines in many countries. The link between eggshell thinning and the presence of DDT and its metabolites in the food chain helped win a ban on this chemical. But DDT is persistent, slow to decay and continues to threaten peregrines and other species. However, the danger is beginning to wind down.

The future would not look so rosy for the peregrine were it not for the efforts of an extremely dedicated group of concerned individuals who believed the peregrine should and would fly again. The cast of characters is lengthy, including biologists and ornithologists, falconers and bird lovers of every sort. Their success story has now come to Montana, and a potential for recovery of one of America's most endangered species is at hand. The setting is the lofty peaks of the Montana Rockies, but the story is theirs.

The Peregrine Fund, Inc. is a private, nonprofit organization



A helicopter transports a plywood "hack box" to a selected cliff location (left and above DFWP photos: Dennis Flath). The box (small dot at top of cliff) serves as a temporary home for the young peregrines prior to release (inset DFWP photo: Tom Warren).

dedicated to conservation of the peregrine falcon and other birds of prey. The group's primary goal is reintroduction of captive-produced peregrines into formerly occupied habitat. In an effort to accomplish this goal, The Peregrine Fund maintains two breeding facilities—in the East at Cornell University in Ithaca, N.Y., and a western operation at Fort Collins, Colo. Years of pioneering research by Dr. Tom Cade and his associates have resulted in development of captive propagation techniques which are considered routine today, yet were little more than casual theories less than a decade ago. As knowledge of peregrine physiology and mating behavior advanced, it was pressed into immediate service to produce young peregrines for reintroduction. These efforts have been so successful that the western operation alone expects to produce more than 100 young peregrines per year by 1982.

At the Fort Collins facility, security is provided by trained guard dogs which pace the perimeter of the fenced enclosure surrounding the breeding barns. Here, the parent stock is housed, eggs are laid and collected, and behavioral studies are conducted. The facility also includes offices, a lab where eggs are incubated and accommodations for raising coturnix quail on which the peregrines are fed. So no contaminants are present in the food chain, the quail are raised on chemically pure feed. This part of the operation is directed by Bill Burnham, a mustachioed falcon biologist who takes great pride in the facilities and the successes of The Peregrine Fund. Raising the young peregrines is a delicate task, requiring close attention to detail and an intuitive ability to know how things are going. Burnham and his co-workers approach peregrine propagation like artists approaching canvas. From egg fertilization to independence, the peregrines are in expert hands.

Once hatched, the young birds are hand-fed until they are several days old. Then, the young are given to adult peregrines for further rearing. These adults are specially designated "imprint birds." Feeding by an adult of their own species results in the psychological imprinting of the facial pattern and behavior of a peregrine falcon on the young birds and eliminates the problem of the young birds growing up thinking they are human. After all, the goal of the project is to produce wild birds for release into natural habitats.

Young birds are held at the Fort

Collins facility until they are about 35 days old. Groups of from three to five birds are matched up according to age and moved out to the various reintroduction (hack) sites around the Rocky Mountain region. Young peregrines can fly at about 45 days, so they are held at the reintroduction sites for about 10 days. This provides an opportunity for them to become visually acquainted with the surroundings and, with a little bit of luck, the young falcons will return to breed at or near the point of release.

The term "hacking" refers to a complex, gradual process of releasing a captive falcon, wholly dependent on human support, into the wild where it is entirely on its own. The location selected must meet a number of basic requirements: presence of an adequate prey base, isolation from disturbance and an absence of predators.

Since peregrines prey primarily on other bird species, an abundance of avian life must be present. This abundance must necessarily be coupled with an open expanse of habitat, such as a marsh, so the falcons can hunt effectively.

Isolation from disturbance is a relative item. It has been achieved in urban areas by using tall buildings for hack sites—a tactic which places the birds far above traffic and human activity. Since those activities are uniform and constant through the seasons, falcons quickly become accustomed to the noise. In more remote areas, however, man-caused Noises are neither uniform nor constant. Consequently, activities such as logging or seismic work should not take place near the hack site from March through August.

Predators are avoided by carefully studying potential hack sites to determine presence or absence of certain "high-risk" species, such as golden eagles and great horned owls. Raccoons are probably the most difficult mammalian predators with which to deal, but foxes, coyotes, bears and martens may also attempt to prey on young falcons. Avoidance is the best policy, but sometimes special steps must be taken to protect the young falcons from predation.

In Montana, the effort to reintroduce peregrine falcons began in spring 1980. Although plans had been in the making for several years, lack of funds had prevented any field work. With the availability of federal grant-in-aid funds via Sec. 6 of the Endangered Species Act, there was an opportunity to get moving. The obvious first step was to determine just how badly the avian prey base in Montana was contaminated with DDT residues. Unfortunately, the necessary chemical analyses would be expensive and could possibly use up much of the money set aside for reintroduction programs.

The U.S. Fish and Wildlife Service (USFWS) had previously conducted some pesticide analysis on peregrine prey species in the Southwest, so the possibility of expanding this work to include Montana was explored. Rod Deweise, with the USFWS Rocky Mountain Field Station, had similar thoughts. When Deweise learned of our interest, he expanded his proposal to include the entire Rocky Mountain region. In a matter of weeks, Patuxent Wildlife Research Center in Maryland had approved Deweise's request. But, it was a one-time study—do it now or forget it. Patuxent would pay for all lab analysis and Deweise would conduct the study and coordinate specimen collections with cooperators in the various states. It didn't take long for the Montana Department of Fish, Wildlife and Parks to decide to participate.

Five general locations were selected within the state, areas which typified peregrine habitat and which were close to those areas where we might wish to introduce peregrines. Twelve specimens of each of five principal prey species were to be taken from each area to determine levels of pesticide contamination in their tissues. Department personnel did the collecting on three areas, while USFWS personnel collected specimens from the other two. By early summer, two large cartons of foil-wrapped, frozen specimens were air freighted to the Rocky Mountain Field Station for initial treatment before chemical analysis. Results of these efforts took a long time to arrive, but they were worth the wait. In terms of pesticide contamination, Montana was one of the cleanest states in the entire Rocky Mountain region, even though high levels were detected in some swallows.

Meanwhile, there were still concerns about funding. True, federal money was available, but a state matching share (one-fourth of the total) was required to take advantage of the program. The department was in the midst of severe financial problems and there weren't funds to initiate a new program.

A search for a private donor to put up the state's share started and ended with Exxon. Exxon had previously participated in a bald eagle project in the East, and we believed the company's environmental concern might be extended to the peregrine. We discussed the project many times with Exxon officials while applying for the grant. Final decision rested with Exxon's Billings office, and the grant was awarded on behalf of the Exxon affiliates operating in Montana, including Exxon Coal Resources and the Carter Mining Co. When we received the news that our grant application had been approved, hack sites were the next order of business.

Deciding on a hack site isn't easy. With the help of Bill Heinrich from The Peregrine Fund, we studied many possible locations. Since several were on Forest Service land, we also began discussing the project with that agency. Everyone we contacted was enthusiastic and ready to roll up his or her sleeves.

While we were evaluating sites, we also began constructing plywood hack boxes, each about 3 by 5 by 4 feet, with a double roof and a barred and screened removable front. Eventually, we hope to have as many as five active hack sites, all clustered within a particular geographic area, to enhance the possibilities of the released birds finding a mate and reproducing on their own in the wild.

Once a hack site was selected, it was a matter of waiting until the birds were ready. The project was now in the hands of The Peregrine Fund. The hack box was placed in mid-June, with the young peregrines scheduled to arrive in early July. The Peregrine Fund had arranged for hack site attendants to care for the birds until they were independent. Again, luck was with us

Bill Heinrich of The Peregrine Fund, Inc., introduces a young peregrine falcon to its temporary "hack box" home. Hack site attendants Ralph and Melissa Rogers spent eight weeks guarding and caring for the young birds (DFWP photo: Tom Warren).

and the services of Ralph and Melissa Rogers were obtained.

Ralph Rogers is a long-time falconer and dedicated raptor conservationist. His wife Melissa shares his enthusiasm for birds of prey, or, as Ralph puts it, "She shares the same rug." With their son Scott and daughter Andi, they spent eight weeks camped near the hack site. They fed the young birds, guarded the site and continually kept track of the energetic young falcons when they began to fly. The hack site attendants essentially take the place of adult peregrines in caring for the young. But it must be done in such a manner that the young peregrines do not associate their welfare with human presence.

The Rogers family did a superb job of caring for the birds. On July 15, 1981, the front of the hack box was removed, and four young peregrines, three males and a female, faced the real world for the first time. There were a few tense moments during the first three days while the youngsters learned to fly. Once they got the hang of it, they became true peregrines, barnstorming through the skies high over the Montana Rockies.

It's an impressive sight to watch the young peregrines play tag. Stoops, swoops, slips and stalls are all part of the game. Like juveniles of other species, the young peregrines concern themselves not at all with the more mundane aspects of making a living. Their job is to play and have fun, rest when they're tired and eat when they're hungry. The food, of course, is always magically there—courtesy of the Rogerses. Each bird was equipped with a small radio transmitter, allowing the human parents to take frequent roll call and see to the safety of these avian adolescents.

As the days passed, aerial play gradually turned to serious education. The skills learned during play became the same skills used to capture and kill their own prey. The young falcons finally became totally independent of the Rogers' handouts and began supporting themselves. On Aug. 20, 1981, the Rogers family pulled out—they were no longer needed. The project was successful, at least to this stage. This spring, however, we will be back watching the skies to see how many of the peregrines are back. We hope to see all four, but natural mortality for first-year peregrines in the wild runs to 70%.

In 1982, depending on continued funding, plans call for from eight to 10 young peregrines to be released at two sites. With Exxon's help, the department hopefully will again fund the effort at one site. Funding for a second site will come from the USFWS and the Bureau of Land Management. Additional sites in future years will possibly include Forest Service participation. Thus, peregrine recovery will be a true interagency endeavor.

Only a few years ago, prospects for survival of the peregrine in the Rocky Mountains was bleak. Today the future looks bright, and the difference is due to public concern over the fate of endangered species. We intend to keep on working until our efforts are needed no more. It's a long, slow, difficult process, but a necessary one.

Success with the peregrine is more than it seems. Success here will help demonstrate that endangered species recovery can be successful—at least in cases where suitable habitat is still available—and will add impetus to the concept of endangered species recovery.

It is still worth repeating that an ounce of prevention is worth a pound of cure. No species of native wildlife should be allowed to become endangered, and management actions on behalf of a species should be taken before a population falls into such desperate straits as to require emergency action on a national scale. Thus, a strong nongame program is the most important complement an endangered species program can have.

The story here isn't over, but we've made a tremendous start. We owe thanks to men and women in the various state and federal agencies for their support and participation, and we owe special thanks to The Peregrine Fund, Exxon and to the Ralph Rogers family. Had any of those critical spokes been missing from the wheel, the project would never have gotten off the ground.

Last, we owe some thanks to the peregrine falcons for their energetic display of aeronautic skill which has inspired our continued efforts.■

From Cream Cans to Tankers

by Jim Schreiber

FISH hatcheries have had a long and colorful history in Montana. The first one was established in 1896 near Bozeman by the U.S. Bureau of Fisheries. The Montana Department of Fish and Game got into the act 10 years later, establishing a hatchery in the bustling mining town of Anaconda in 1906, and another on the northwestern shore of Flathead Lake near Somers in 1912.

By 1914, state hatcheries were propagating cutthroat, brook and rainbow trout, as well as Arctic grayling and lake whitefish. In those days, the scope of the department's fisheries activities was relatively narrow. Other than setting bag limits, seasons and establishing closed areas, management consisted primarily of collecting spawn, hatching eggs and rearing and planting fish. Distribution and planting was done largely by the "cream can" method: Metal cream cans were filled with fish, loaded onto railroad boxcars and shipped to prearranged points where department employees, members of sportmen's groups or other individuals picked them up and transported them to nearby lakes and streams.

In the 1920s, Montana's fish hatchery system experienced a boom. It was the department's policy to establish many small hatcheries around the state rather than a few large ones, because transportation equipment in that era would not permit moving fish long distances. Thus, permanent facilities were established at Great Falls, Lewistown and Big Timber. Two other stations, one at Emigrant, along the Yellowstone, and one at Hamilton, along the Bitterroot, were also established at this time (neither of these exists today).

In addition, many spawning sites were maintained on a seasonal basis so that eggs could be obtained for the hatchery system. These sites were located on natural spawning runs along streams, where fish traps were constructed to capture adult fish as the spawning run progressed. These trapping areas also attracted other interesting characters, most notably bears. Early field workers reported that such problems were solved by first giving the uninvited bruin a swift kick in the tail. If it ran off, it was a black bear. If the worker ran off, it was a grizzly!

Most early hatcheries were developed where springs were available to provide adequate sources of clean water. In some instances, land and labor were donated by concerned citizens and sportsmen's groups. Many people were dabbling in fish culture at that time, and fish

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• *Much of the information in this article on early fish hatchery operations was drawn from an unpublished manuscript about the Fisheries Division written by William Alvord, retired career employee of the Montana Department of Fish, Wildlife and Parks.*—Ed.

Transportation equipment in the early days of Montana's fish hatchery program (far left) lacked the sophistication of today's tankers. Modern tank trucks (DFWP photo: Mike Aderhold) used to transport fish have several life support systems, including a means for adding oxygen to the water, agitators to expel ammonia and other waste products and ice to keep the water cool during hot weather. The temperatures of the tank and lake water must be approximately the same before planting takes place.

In the above photo, eggs are being stripped from a female trout (DFWP photo: Bill Thomas). Montana fish hatcheries have two sources of eggs: wild stocks and domestic stocks. Wild stocks of eggs are obtained from fish in certain natural spawning areas. Domestic stocks are taken from adult fish reared and maintained in our hatcheries. At left, modern "pelleted" fish foods are scientifically formulated to produce healthy, vigorous fish for planting (DFWP photo: Mike Aderhold).

eggs were frequently traded with or purchased from other states in an effort to expand the number of fish species available to Montana anglers. These efforts resulted in successful establishment of such desirable species as brook, brown and golden trout; largemouth and smallmouth bass, and walleye. Unfortunately, they also resulted in introduction of rough fish like the carp, causing native fish populations to deteriorate in many waters. To deal with the problem of indiscriminate planting, the Legislature eventually passed laws making it illegal to transport or plant fish in Montana without approval of the Department of Fish and Game.

The post-Depression years of the 1930s brought slow but continuous growth to Montana's hatchery system. New buildings, raceways and ponds were built to increase production. Construction projects that might not otherwise have been possible were accomplished at various hatcheries through the relief programs of the Civil Works Administration and the Federal Economic Recovery Administration. During this period, many stock ponds and irrigation reservoirs were constructed under auspices of the Public Works Administration; also, many dams were built on Montana's rivers, impounding large amounts of water and further increasing the demand for hatchery-reared trout.

The late 1930s saw the introduction of the airplane as a means of transporting fish for stocking in remote areas. Airplanes were used to carry cream cans of fish, and fish were also dropped directly into alpine lakes. (Today, the Department of Fish, Wildlife and Parks uses airplanes and helicopters to drop about 150,000 trout each summer into alpine habitats.)

Rough fish, such as carp and suckers, continued to be a problem in many of Montana's drainages. Several commercial fish processing operations were established to utilize this resource. These operations produced fish oil, pet food and, in some cases, fish feeds. Fish feeds at that time consisted mainly of ground horse meat and fresh animal protein, such as liver. Needless to say, daily routine for hatchery workers included many long hours in the feed-grinding room refining animal flesh into meal small enough for fish consumption. With the demise of the rough fish processing operations, it was to be many long years before satisfactory commercial fish feeds were available.

During the 1940s, a five-year program was undertaken to stock waters suitable for planting across the entire state. The state was divided into 14 major drainage districts (Yellowstone National Park formed the 15th), and an intensive review of these waters was conducted to determine their suitability for stocking. This effort was aided greatly by U.S. Forest Service personnel and local residents, as well as Montana State College (now Montana State University) in Bozeman.

Two major hatcheries were added to the system in the 1940s: one at Arlee in 1945, and another (the Bluewater) near Bridger in 1948. A warm-water facility, the McNeil Pike Hatchery, was also established below Nelson Reservoir near Malta. This station, which produced northern pike and walleye fry, was later discontinued because the water was too cold.

This decade saw the beginning of a gradual change in fisheries

In the early 1900s, fish planting was done primarily by the "cream can" method: Metal cream cans were filled with fish, loaded onto railroad cars, such as the "Thymallus" pictured above, and shipped to prearranged points. Most early hatcheries (below) were developed where springs were available to provide sources of clean water (DFWP photos).

management in Montana, as emphasis began to shift from quantity of hatchery fish produced to overall quality of the fishery. Fisheries personnel were exploring new ideas and techniques to cope with problems brought about by increasing pollution, siltation and dewatering of streams. Greater management efficiency was accomplished through establishment of a fisheries research section in the department, improvement of fish distribution tanks and trucks, installation of refrigeration units for food storage at hatcheries and expansion of the rearing pond program. Fish feeds were being improved through systematic testing of various combinations of animal, fish and dairy products.

Progress and improvements in fish culture and research continued in the 1950s. Fish survival during transportation improved as better aerated and refrigerated tanks were developed. Better information on fish distribution throughout the state enabled department personnel to avoid introduction of incompatible species and to maximize the return of fish to the sportsman for his license money.

Fish tagging and marking operations were introduced to study fish growth, and productivity was determined by creel census work. Early crew members collected fish specimens for study with sport fishing gear, since it was the best means available at the time. Many jibes were received about getting paid for "going fishing," but the crew members welcomed any and all to try their hand at fly-fishing on a full-time basis, to see if it was then such an attractive job!

By 1953, 12 trout hatcheries were operating across Montana. This decade marked the beginning of a tremendous boom in production of hatchery-reared trout. Larger and larger fish were planted, in an effort to provide more fish for the creel. But increasing biological research began to question the effectiveness of put-and-take planting. Studies showed that the key to better fishing and healthier fish populations was not simply to stock more and more fish, but to protect and maintain good fish habitat. In other words, where good habitat exists, widespread planting of fish is rarely necessary, and may even have detrimental effects on native trout populations.

In response to these biological studies, the role of Montana's fish hatcheries began to change. Perhaps the biggest turning point was a study on the Madison River in the 1970s, which showed that planting actually cut the wild trout population about in half, due to crowding and stress.

Today, the major thrust of the hatchery system is to produce smaller fish for stocking lakes and reservoirs that have adequate conditions for fish growth but inadequate conditions for natural reproduction. Just as many fish are being planted as ever—more than 7 million in 1980—but emphasis has shifted from streams to lakes, and increased effort is now being devoted to native species. The Murray Springs Trout Hatchery, built to partially mitigate fishery losses due to the Libby Dam Project, was completed in 1980 and enhances the supply of native west-slope cutthroat trout for Montana waters. Thus, while the direction of the hatchery system has changed over the years, the total output and importance of the program to the state's fisheries resource have not diminished.

Montana's hatchery system has grown from modest beginnings in the early 1900s to today's complex of scientifically managed facilities. Many of the buildings and ponds, however, date back to the 1920s and must soon be renovated. The program has changed over the years, but it is important to remember that one-third of Montana's fishing is on waters that are planted. Montana's hatcheries will continue to play an important role in fisheries management as long as there are fishermen.■

Out of the Closet
continued

Realizing I had skied myself into a jam, I turned to survey the return trip. It didn't take long to figure it would be fast. The pride that goaded me up the steep mountain alone gave me another jab—although my skiing skills had improved, they simply weren't any match for what I was peering down. Throwing caution to the wind, I began my descent. About a third of the way down, reckless abandon shifted into hopelessly out of control. A clump of aspen that seemed small when I started suddenly got very big very fast. As I considered another ditching effort, misfortune lent a hand. The tip of my right ski plunged below the crusted surface, and my efforts to bring it up resulted in the opposite happening—driving the ski straight down into the soft, powdery snow. As I flipped head over heels, I heard a sickening "snap."

Alone and four miles up an isolated mountain trail, my first thoughts were: "Do I remember my Boy Scout and Army first aid? Is a fracture worse than a compound fracture, or is it the other way around? Can I wiggle my toes?" This mental bantering soon gave way to reality. I couldn't wiggle my toes, but judging from the position I was in, it wasn't any wonder. Struggling around to a half-submerged, sitting position, I ran my hand down my leg. No bones were sticking out. I tried my ankle and, even though it was sore, it didn't feel broken or sprained. However, one ski felt lighter than the other. Pulling it to the surface I discovered why—the snap had been my ski, not me.

The splintered ski made it all too apparent that the walk down the mountain would be both long and cold.

I was right. It was long and cold. It was also a difficult way to learn that unless a person is an experienced cross-country skier, well versed in survival techniques and first aid, it's foolhardy to overestimate one's skills—a very real danger in cross-country skiing since a person can become proficient in a relatively short time. This, combined with the fact that a three-foot blanket of snow turns even the tamest looking mountain landscape into an instant wilderness, can result in thoughtless, dangerous experiences for novice and veteran alike.

Since I vowed never to go cross-country skiing alone, I had to talk my friends into trying it. This proved easier than I had supposed. But it didn't help my second problem—who would have one cross-country ski, in my size, for sale?

Being a better persuader than I imagined, a number of the people I urged to try cross-country skiing did. While they were learning about pine tar, waxing and basic techniques, I was back rooting through sporting goods stores, getting even stranger looks than before.

"Why no, we don't sell single skis," was usually followed by a strange glance and quizzical frown. I finally ventured back to the small sporting goods store.

By this time, I was getting a little gun-shy about asking for one ski. Without saying a word, I went over to the cross-country ski racks and began looking through the stock. I counted the skis and there was an odd number.

"This can't be," I thought. I counted again and, sure enough, there was an extra ski.

The manager came up and asked, "Interested in buying a pair of skis?"

"Not exactly," I replied, hoping I could broach the subject without sounding too nutty.

"I hate to tell you this, but the ski you have is a single. The other ski was broken in shipment and, even though we were reimbursed by the company, they didn't want it back, so I put it out, thinking someone might have a use for a single ski," the owner said.

I briefly told him about my accident, he gave me a reasonable price and soon I was back skiing.

As my competence grew, so did the sport's popularity. The convenience and general ease of learning proved as attractive to others as they did to me. During my first winter, if I found another ski track, it was almost like Robinson Crusoe finding Friday's footprint. But today, ski trails seem to appear and fan out through the countryside at the merest hint of snow.

The popularity of the sport not only resulted in more and varied skis and skiing accessories, but it also gave way to stronger, faster and "better" skis. Sticky, pine-tarred fingers were replaced by hands that never felt tacky pitch and noses that never smelled the pungent odor of burnt pine. These same hands and noses were now atop Space-Age skis made of fiberglass or steel and featuring waxless bottoms.

Admittedly, I find it uncomfortable in the mere course of a decade going from the vanguard of a sport to dragging along in the rear guard. Although I'm no longer hesitant about professing my preference for cross-country skiing, the equipment revolution has provided me with a new source of sensitivity:

"What a wonderful area, Tom! How did you find out about it?" a friend asked as four of us piled out of his rig.

"Oh, this is where I almost broke every bone in my right leg when I was learning to cross-country back in '71," I replied.

The person who was getting the skis out shouted, "Hey, who brought the wood? Somebody think we'd need some kindling for starting a fire?"

"And look at this," he continued, pulling the two skis out and holding them aloft, "They're from different trees!"

Three people laughed. The fourth one didn't.■

Wildlife Shorts

Young otters must be taught to swim. The mother otter endlessly coaxes and wheedles them and, as often as not, she ends up by tricking them into learning to swim.

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Skunks live only in North America. All species are black with various stripes or spots of white.

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The tails of animals serve as fly-swatters, signals, instruments of communication, extra hands and tools with many uses.—*Vince Yannone, youth educator, Conservation Education Division*